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ABSTRACT

This book, one in the series on Aerospace Education I, emphasizes the two sides of aerospace--military aerospace and civilian aerospace. Chapter 1 includes a brief discussion on the organization of Air Force bases and missile sites in relation to their missions. Chapter 2 examines the community services provided by Air Force bases. The topics discussed in Chapter 3 are Air Force community relations and various educational opportunities available to personnel. Chapter 4 deals with the functioning aspects of the aerospace industry. The last chapter lists a large number of careers with a brief description for each of them. A section in this chapter explains the required education standards for most of the Air Force jobs. The book is designed for use in the Air Force Junior ROTC program. (PS)

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AEROSPACE COMMUNITY

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AIR FORCE JUNIOR ROTC
AIR UNIVERSITY/MAXWELL AIR FORCE BASE, ALABAMA

SE 017 450

AEROSPACE EDUCATION I

Aerospace Community

V. V. Mickey
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AIR FORCE JUNIOR ROTC
Air University
Maxwell Air Force Base, Alabama

1973

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Preface

AEROSPACE has become a fact of life in the United States. Whether we are aware of it or not, our way of living, even our way of speaking, has been affected by aerospace developments.

The growth of aviation and space exploration has brought new directions in education, new industry, and new careers. It would be difficult today to find many businesses or professions that are not touched by or engaged in some part of the aerospace world. Aerospace products and by-products are in everyday use, and hundreds of thousands of jobs have been created.

Since the aerospace community has assumed such an important role in our society and includes so many fields of endeavor, it is important that we learn something about it. It would be impossible to discuss all the aspects of aerospace in this brief text, but we will look at as many of them as space will permit.

As you will see, the aerospace community is really two overlapping communities. There is the military community and there is the civilian community. In discussing military aerospace, we look only at the Air Force since it is the largest military user of aerospace products and techniques. Discussion of civilian aerospace will include the industries engaged in manufacturing aerospace products, the Government agencies concerned with aviation or space, and the commercial airlines.

In surveying military and civilian aerospace, this text places emphasis on the educational opportunities

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offered by the Air Force and on civilian and military job opportunities. Again, due to space limitations, the jobs described here are only a sampling of the total field, but they will give you some indication of the types of careers to be found in aerospace and the kind of education and training they require. You will notice that many Air Force jobs have their counterparts in the civilian community. If you decide to join the aerospace community, whether as a member of the Air Force or as a civilian, you will find no lack of interesting careers from which to choose.

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Chapter 1

The Organization and Planning of Air Force Bases

THIS CHAPTER discusses the organization of Air Force bases and missile sites in relation to their missions and examines the principles that govern air base planning. First, the chapter traces the historical development of Air Force bases and points out the factors that have caused changes in base requirements. Next, it describes the location and construction of missile sites. Lastly, it explains the concept of master planning and outlines the factors to be considered in planning an Air Force base. When you have studied this chapter, you should be able to do the following: (1) explain the difference between the primary mission and the support mission of an Air Force base; (2) discuss the changes which occurred in aircraft development during World War II, which had corresponding effects on air base development; (3) discuss the new types of ground installations which were created to accommodate the missile and space missions of the Air Force; (4) discuss the factors which must be considered before a site can be selected for the construction of an air base; and (5) explain how the functional activities of Air Force bases are related to master planning.

THE PEACE and security of the United States depends on the capabilities of its Armed Forces to respond quickly and effectively wherever and whenever aggression may threaten the United States or its Allies. This responsibility is shared by the Army, the Navy, and the Air Force, each service doing the job for which it is best suited.

THE AIR FORCE MISSION AND ORGANIZATION

The specific mission of the Air Force is to support national objectives by gaining and maintaining aerospace supremacy. To accomplish this mission, the Air Force must be organized, trained, and equipped to operate at any altitude above the earth where it may become necessary to defeat enemy forces regardless of whether such forces are on land, at sea, in the air, or even beyond the atmosphere.

To do the job, the Air Force maintains a state of constant readiness to apply necessary force promptly, effectively, and as economically as possible. This state of readiness can be achieved only by efficient organization at every Air Force level.

The Air Force is organized into 15 major commands, each of which is responsible for a part of the overall mission, and 10 separate operating agencies, each of which is responsible for a special function of the Air Force.

The major air command is the largest functional division of the Air Force. Below the level of the major command, the levels of command (echelons) in descending order are: numbered air force, air division, wing, group, squadron, and flight. Since simplicity of organization is an important consideration of every Air Force command, a given echelon is used only if it is needed. Therefore, all levels or echelons will not necessarily be found in any one major command. For example, combat wings may be assigned directly to a numbered air force when the number of such wings is too small to warrant the establishment of air divisions. In this instance, the numbered air force exercises direct command and control of the wings. Air Force organization is covered in some detail in the AFJROTC text *Military Aerospace*. The brief discussion above is included only as it relates to air base organization.

AIR FORCE BASE ORGANIZATION

The organization of an Air Force base is tailored to the mission of its occupants. Whether a base is occupied by one or more wings or only by a squadron, it will always have a commander for those units engaged in carrying out the assigned primary mission and also a base commander who is responsible for accomplishing the base support mission. **Primary missions** consist of major functions such as combat flying, training, and transport. **Support missions** include providing transportation, supplies, security, and similar services. An example of a support organization is shown in Figure 1.

Some bases contain parts of more than one command. In such instances, the command having responsibility for the base is called

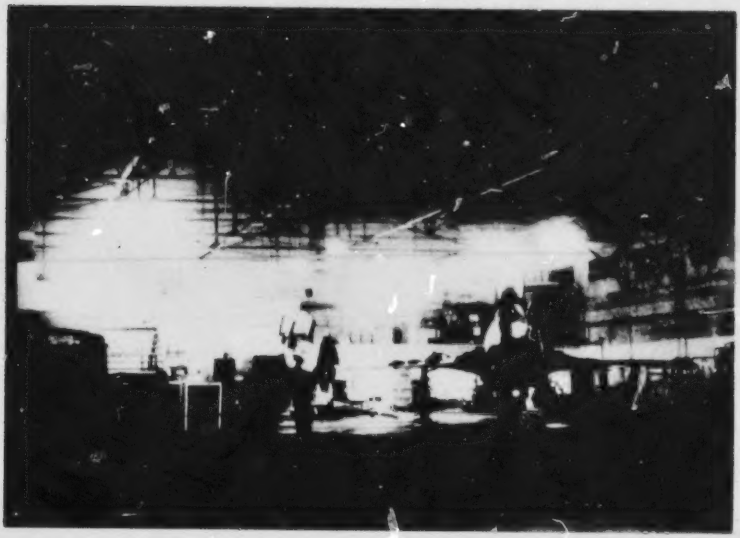

Figure 1. Interior view of a base maintenance shop.

the **host command,** and elements of the other command or commands are tenants on the base. The host command provides support facilities for its own primary mission as well as for the primary mission of the tenant units. This multimission concept is a major consideration in the planning for Air Force bases.

The Evolution of the Air Force Base

Modern Air Force bases bear little resemblance to early military airfields. This is particularly true of bases with concrete runways, electronic support and control systems, and other modern facilities, all designed for one purpose—the support and operation of modern aerospace forces.

The term "air base" did not come into common usage until after World War II. Prior to that time, aviation activities often occupied only part of an Army post. These early facilities were called fields. Frequently, they were little more than sod pastures with only limited support facilities (Fig. 2). Later, aviation facilities assumed a variety of names, such as aviation repair depot, balloon school, aerial gunnery field, aviation supply depot, engine repair depot, and air station. As aircraft became heavier, faster, and more complicated, they required separate facilities constructed solely for flying.

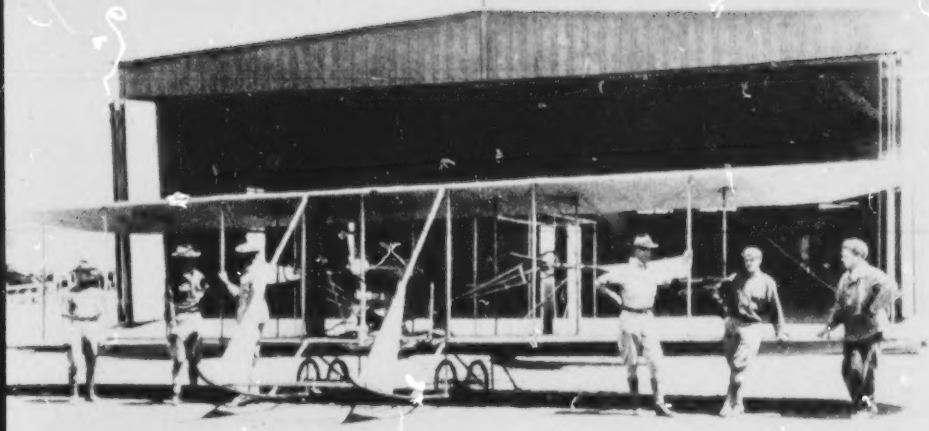

Figure 2. US Army's first airplane, Wright Type B, Fort Sam Houston, 1910

When Orville and Wilbur Wright made their first heavier-than-air flight, they did not need the complex facilities required by modern aircraft. The runway was only a single starting track 60 feet long. In developing their crude vehicle and its supporting facilities, however, the Wright brothers established a principle that still controls the planning and development of modern air bases. They built their aircraft first and then patterned their flying field to meet the needs of the aircraft. As Air Force weapon systems change their characteristics and capabilities, so must air bases change to accommodate them.

The first organized use of aircraft for military purposes came during World War I. Military aircraft of that day were slow-moving, wood-and-fabric vehicles, capable of operating only within a very restricted area. They were simple in design, light in weight, and limited in number, and they required only short takeoff and landing runs. Aviation was still in its infancy, and the air base as we know it today, was only beginning to develop. A conveniently located grass-covered field with adequate drainage and a reasonably level surface could serve as an airfield.

The aircraft of World War I did not require an extensive system of airfields. The airfields were usually located near the front lines because a savings of just a few miles would increase the combat capabilities of early aircraft. Consequently, any major advance or retreat by the opposing forces required a corresponding change in the location of airfields. Only a few pilot training bases were developed in secure areas away from the fighting. Although these training bases expanded rather rapidly and in-

cluded more and better facilities, they could not be compared with even the smallest of today's air bases. However, a number of these early sites remained active after World War I and became bases for extensive combat flying operations during World War II.

Changes in Base Requirements

During the two decades between World War I and World War II, materials used to build aircraft changed drastically from wood and fabric to much stronger aluminum alloys. All-metal aircraft driven by engines 10 times more powerful than those used in World War I considerably increased the ranges. During World War II, transoceanic flights became frequent; and massed aerial assaults against Germany and Japan became everyday events. Before the close of World War II, jet fighters had been developed, and in 1947 an aircraft exceeded the speed of sound for the first time.

Improved and expanded air base facilities were needed to handle the new aircraft (Fig. 3). The heavier, faster, more complex models required longer and wider runways. These runways had to be constructed of a heavy substance such as concrete to be able to withstand the weight of the new aircraft. As aircraft became larger and more powerful and as flying operations increased, aircraft servicing activities multiplied. Permanent buildings

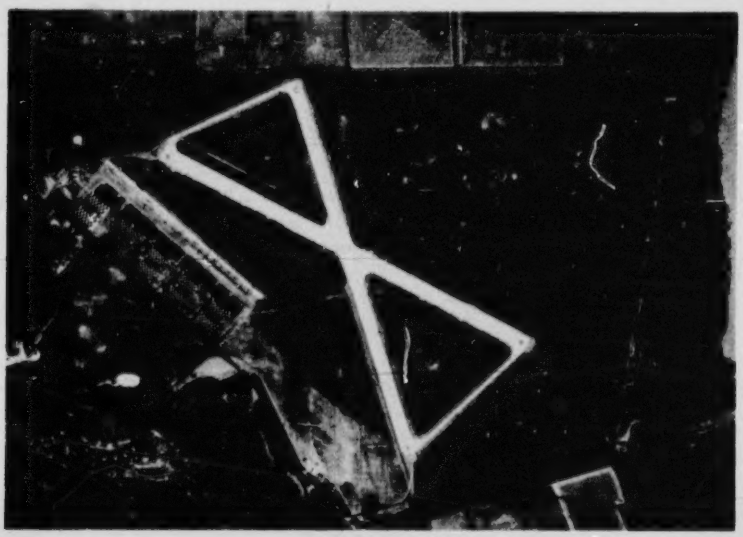

Figure 3. Hamilton Field, California, 1939.

and supply warehouses equipped with modern safety devices became necessary to keep combat and training aircraft ready to fly. New bombers dwarfed existing hangars and required additional hangar and shop facilities for maintenance of equipment and operating systems. Because of the increased speeds at which new aircraft traveled, bases had to be equipped with sophisticated traffic control systems. In place of small groups of fliers and mechanics, thousands of people were needed to operate the new air base. Individual and family housing complexes were built, and the air base became an organized, self-sustaining unit.

As aircraft continued to increase in size, range, and speed, the specialized functions of fighters, bombers, transports, trainers, and other aircraft developed; and this specialization required that the integrated systems of air bases be adapted to these specific missions. This was the beginning of self-supporting systems for training bases, specialized supply centers, air defense bases, strategic air bases, and others. Air bases no longer had to be near enemy lines but could now operate over a more extensive area.

Although air bases have grown steadily larger and more complex, not all Air Force ground installations are large. But, the small, remote radar station on the DEW (distant early warning) line is as much a part of the Air Force's overall capability to defend the United States as larger, better known air bases.

Between the large, complex air base and the much smaller installation such as a radar station has come a new requirement for aerospace power—facilities for missiles.

Missile Sites

Missiles and atomic weapons resulted in other changes in base requirements and design. For example, **missile sites** do not include all of the housing, recreation facilities, runways, and other features normally associated with an air base. To avoid the construction of such facilities, missile sites, (which include everything essential to the operational readiness of the missile) are constructed in the vicinity of existing air bases. These bases furnish technical and logistic support (supplies, maintenance, transportation, and other services) and community recreation and housing facilities to the missile site. Air Force personnel who man the missile sites often live at or near the air base and shuttle between the two locations.

Missiles and their launching sites were developed rapidly after World War II without the benefit of past testing and experience. Unlike air bases that had been expanded and improved over the years, missile sites were constructed in a very short period of time as completely new installations with an outlay of millions of dollars for each site (Fig. 4).

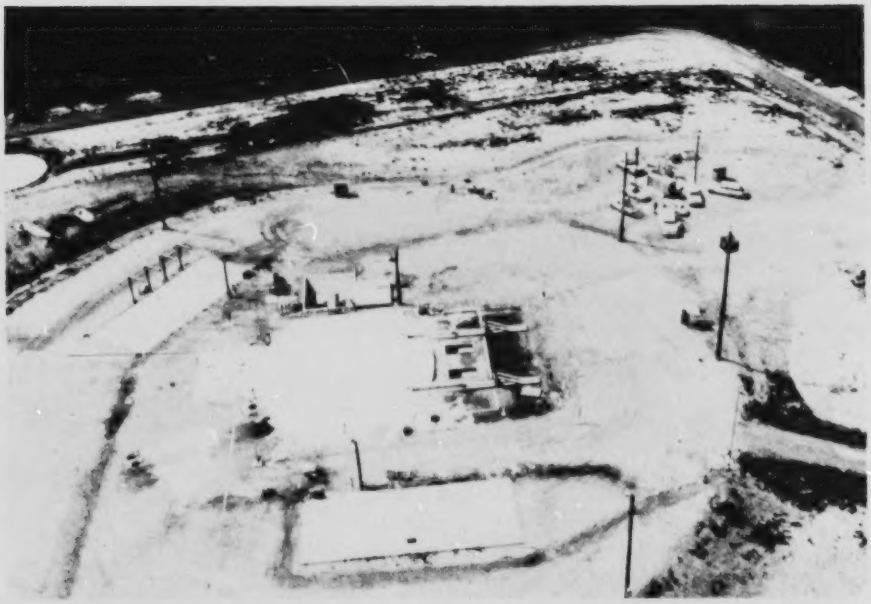

Figure 4. Aerial view of the Titan II missile site #18 at Little Rock, Arkansas.

Missile sites are described as soft, semihard, or hard, depending upon their structural design. At first, **soft sites** were constructed entirely above ground, but they were extremely vulnerable to enemy attack; **semihard sites** were also constructed above ground level but had the advantage of reinforced concrete. In most instances, modern missile sites are **hardened,** meaning that they are located entirely underground in reinforced concrete to protect them from the blast effects of a nuclear explosion (Fig. 5). The control centers, power units, and maintenance and other required facilities are located underground and linked together by a series of service tunnels.

In February 1962, the Department of Defense assigned additional responsibilities to the Air Force for support of the National Aeronautics and Space Administration (NASA). To fulfill this responsibility, the Air Force made numerous changes in base design and spent billions of dollars constructing test and research centers for space activities. Space centers not only include conventional facilities but also have unique requirements of their own. At Cape Kennedy, Florida, and Vandenberg Air Force Base, California (Fig. 6), for example, there are some of the most sophisticated space facilities in the world. Buildings which dwarf

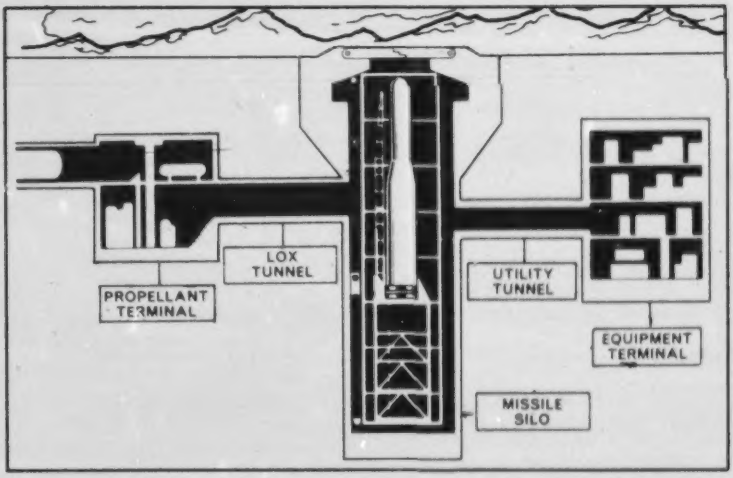

Figure 5. A Titan launch station, hard site.

conventional control towers, transportation equipment the size of half a football field, and electronic devices capable of controlling the movement of spacecraft hundreds of miles above the earth are a few examples. With the futher development of propulsion systems (engines and accessories) and remote-controlled guidance capabilities, orbiting bases and permanent bases on the moon may become a reality. Wherever they may be located, however, future Air Force bases will continue to be planned to meet the needs of their assigned missions.

MASTER PLANNING

As it applies to an Air Force base, **master planning** is the development of an overall plan for the use of land and facilities. It applies to existing bases and to sites selected for the construction of new bases. A master plan provides two kinds of information: (1) the present composition of the base, its buildings, utilities, and roads and the use being made of them, and (2) the way an existing base or a new base may be developed to support continuing and future missions.

Master planning began in the closing years of World War II at a time when technological developments had moved ahead of existing facilities. Not only were the old runways and support facilities inadequate for the new aircraft, other base facilities such as

hospitals, housing, and parking spaces could not accommodate the expanding personnel.

Long-range plans were developed for each base to allow for systematic changes in facilities. Steps were taken to insure that new bases would be properly planned and constructed. Thus, the **multimission concept** became a part of master planning.

It is not uncommon for the modern Air Force base to have several major air command units on it at the same time. Davis-Monthan AFB, Arizona, is an example of such a base. The host command, SAC, maintains both a Titan II missile wing and a reconnaissance wing for U-2 aircraft training. One of its tenant commands, TAC, maintains a fighter wing for A-7D aircraft training and operation. Its other tenant, AFLC, owns and operates the Military Aircraft Storage and Disposition Center (MASDC) "boneyard," which stores or disposes of aging aircraft.

Figure 6. Launch of a US Air Force Minuteman II missile from Vandenberg AFB, California.

Although very important, the multimission concept is only one of the principles used in master planning. In many instances, the type of civilian community in which a base is located has a direct influence on the types and numbers of buildings and other facilities provided on a base. For example, it would be impractical and unwise to construct houses for the families of all Air Force personnel who work on a base if adequate housing is available in the local civilian community. On the other hand, a base located in a sparsely populated area or in an area outside the United States may require housing for all the people who work on the base. The same is true for other requirements of the base, such as recreational facilities or religious activities.

Other principles of master planning relate to the placement of facilities for their most efficient use. Buildings are located to take advantage of the terrain and are spaced to provide adequately for light, the circulation of air, and fire safety clearances. Also, related or intersupporting functions are grouped together. For example, the control tower must be close to the runways, and the maintenance hangars must be easily accessible to the aircraft parking ramps. Sources of noise, such as jet aircraft, are situated as far as possible from housing and the hospital. All of these principles are considered in master planning whether for an existing base or a proposed new base.

Selecting the Site

The first step in planning for a new base is the selection of the site. When a new base is needed, the Chief of Staff, USAF, appoints a site selection board. This board may be composed of military or civilian personnel, or both, with enough engineering and planning knowledge to study and analyze potential sites. Once the site has been determined, the board forwards its recommendation to Headquarters USAF for approval. Sometimes, more than one site is submitted for consideration, in which case Headquarters USAF makes the final decision. The choice is then submitted to Congress for approval and funding.

The site selection board recommends a site on the basis of several important considerations. Approach zones should be unobstructed, there should be good natural drainage; and the site should require a minimum of grading and clearing. These features can be determined by a topographical survey. Other important considerations are the composition of the soil and the depth of the water level. By taking soil samples at various levels, conditions that might be detrimental to runways, taxiways, and drainage systems can be discovered.

Open undeveloped land usually is cheaper than rich farm land and is not as desirable for industrial or residential purposes. Property may be obtained as a gift to the Government or by purchase.

Even though a site may be ideal in every other respect, it must be accessible. Roads, railroads, and rivers are as necessary to an Air Force base as they are to a civilian community. If there is a railroad, does it provide sufficient trains to meet base needs? What kind of motor freight service is available? Are existing roads and airports adequate to support the flow of goods and personnel for the base? These are among the factors that must be considered in the selection of a new site.

Equally important is the availability of electric power, gas, water, sewage systems, and communications. Air bases use large amounts of electricity for lighting, shop operation, and other services. If power is not locally available, can the nearest sources be expanded? Does the local community have an adequate water supply and sewage disposal system to accommodate base needs?

When all these requirements have been met and the site has been acquired, the next step is to plan the location of facilities.

Placement of Functional Activities

The functional activities of the average Air Force base are classified as airfield, industrial, administrative, community support, housing, and community recreation. Figure 7 suggests the basic thinking of the planner in arranging for the placement of various primary activities. Except for the airfield portion, the typical arrangement takes on the appearance of a modern civilian community. However, just as no two civilian communities are exactly alike, no two Air Force bases are identical.

AIRFIELDS AND AIRCRAFT SUPPORT.—The airfield is that part of the base devoted to the operation of aircraft. It includes not only runways and taxiways, but also approach and clear zones. In keeping with the multimission concept, these basic elements are designed and laid out to accommodate the types of aircraft in the current inventory and those planned for the foreseeable future.

An important element of the airfield is base operations, which is the center of all flying activities. Other elements include facilities for storing, distributing, and dispensing petroleum, oil, and lubricants (POL); aids to air navigation (airfield markings, lighting, and radio and radar navigation aids); and maintenance and hanger facilities (Fig. 8). The functions of these elements will be discussed in chapter 2.

INDUSTRIAL AND ADMINISTRATIVE AREAS.—Industrial and administrative **work areas** are located near living areas. They are separated from the airfield work area for reasons of safety (aircraft, fumes,

Figure 7. A typical base layout.

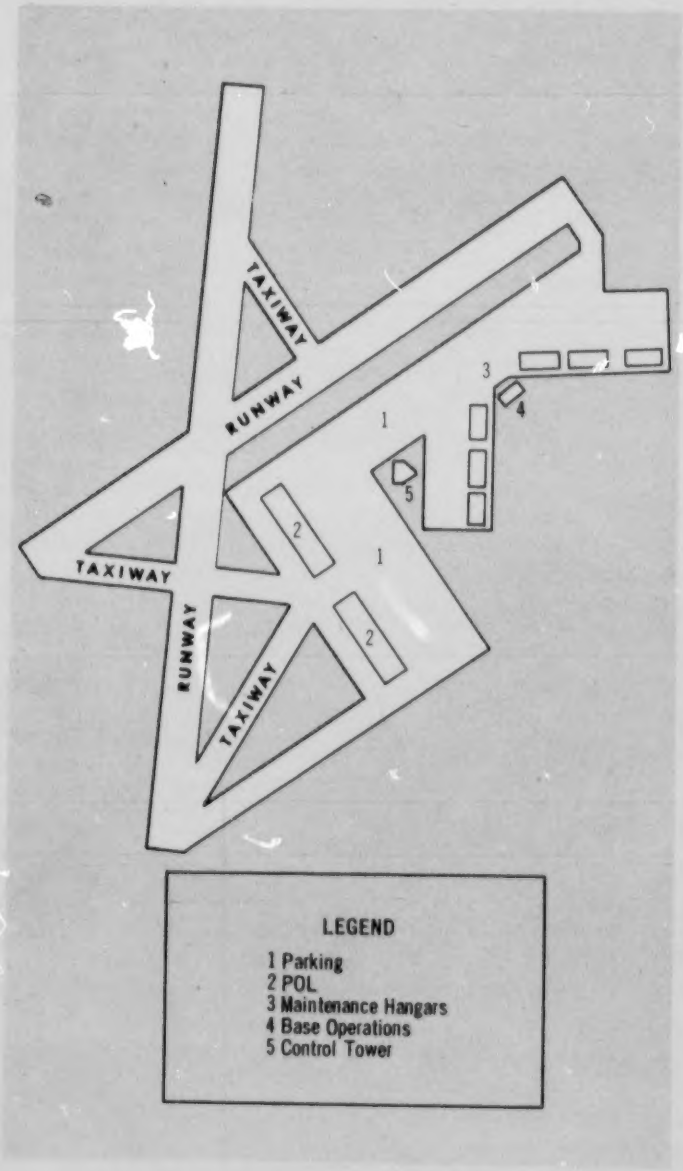

Figure 8. Elements of an airfield.

and fire) and noise. Interrelated work areas, such as airfield aprons and supporting shops, are located as conveniently as possible to the airfield. Certain industrial facilities (storage areas, warehouses, and maintenance shops) are positioned so that they are accessible to heavy transportation systems and large-capacity utilities (electricity, gas, and water). The administrative area is comprised of offices, operations buildings, photo laboratories, libraries, lecture halls, communications buildings, security police facilities, and other structures necessary for administrative activities. For the most part, all buildings in these categories are basic units designed for flexibility and multiple use. This is the reason that a person traveling from one base to another notices the similar appearance of many buildings. Often, only minor alterations are necessary to adapt these buildings to a particular local mission.

Housing, Community Support, and Community Recreation

The portions of the base containing housing, community support, and community recreation activities are the **living areas.** These areas are normally located on reasonably level land to keep down the high cost of grading and to provide adequate parking space.

Community support and recreation areas are located as close as possible to the housing areas. Schools and churches are usually within walking distance, and the safety of pedestrians, particularly children, is a major consideration in the selection of these sites. Safety is also a determining factor in the location of parks, playgrounds, swimming pools, and other recreational facilities. Within convenient driving distance and near major routes on the base are the hospital and the shopping and service facilities.

Providing the many facilities that are needed in a modern Air Force base is a large and complex task. Many factors in design and location must be taken into consideration in master planning. A large permanent base includes virtually all of the facilities and services to be found in a fair-sized civilian community. It is, in fact, a city in itself and is the focal point of Air Force community life.

WORDS AND TERMS TO REMEMBER

primary mission
support mission
host command
missile sites
soft sites
semihard sites
hardened
master planning
multimission concept
site selection board
functional activities
work areas
living areas

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REVIEW QUESTIONS

1. **What is meant by the multimission concept? What are the differences between host and tenant organizations?**
2. **What were some of the characteristics of World War I aircraft? Describe a typical World War I airbase.**
3. **How does a missile site differ from other kinds of Air Force installations?**
4. **What changes occurred in the construction of aircraft during World War II? How did these changes affect air base construction?**
5. **Name the three types of missile sites. What characterizes each type?**
6. **What are some of the principles of master planning?**
7. **What factors would influence the selection of a site for a new air base?**
8. **On a typical Air Force base, what would determine the placement of airfields? Of industrial and administrative areas? Of community support, housing, and community recreation areas?**

THINGS TO DO

1. Obtain maps and informational brochures from bases in your state or region. Report on the primary mission of these bases and on how the layout of the bases reflects these missions.
2. Report on the facilities which would be found at a remote radar station on the Distant Early Warning (DEW) line or on the space-related facilities at Vandenberg AFB, California.
3. Develop a master plan for an imaginary Air Force base. First, select the primary mission of the base, then decide what functions will be necessary to support the mission and how they should be arranged.

SUGGESTIONS FOR FURTHER READING

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CHANDLER, CHARLES DE FOREST and LAHM, FRANK P. *How Our Army Grew Wings.* New York: Ronald Press Co., 1943.

CHAPIN, F. STUART, JR. *Urban Land Use Planning.* Urbana, Illinois: University of Illinois Press, 1965.

Chapter 2

The Base as the Center of an Air Force Community

THIS CHAPTER defines "community" and explains how the term applies to the Air Force as a whole and to individual Air Force bases. First, it discusses the services and facilities provided by air bases for the benefit of the people who live and work on a base. Next, the chapter describes the activities of a base which support the primary mission. Lastly, it discusses the worldwide distribution of Air Force bases, explaining the purposes of the distribution and describing some representative bases in the United States. When you have studied this chapter, you should be able to: (1) outline the community services provided by Air Force bases; (2) explain the functions of the base support activities and note the similarities between some of these activities and those provided by city governments; (3) define the US policy of deterrence and explain how the worldwide system of Air Force bases supports this policy.

THE TERM **community** can mean a variety of things. In a broad sense, it is used to describe groups of people who have interests, objectives, or characteristics in common. In a narrow sense, it means people who live and work together in a particular geographic area. For example, towns or cities, where people live and work together are communities. Also within a city there may be other groups which have special interests in common—racial background, occupations, or goals. A "church community," or a "school community," are examples of this meaning of the word community. In the same way, community can be applied to much larger groups who form a unit because

of shared beliefs, interests, or goals. Thus, we may speak of our state or our country as a community and, in an even larger sense, we use the term "community of nations" to refer to countries which are allied in a common effort to achieve certain goals.

The Air Force community is a community in both the broad and the narrow sense of the word. In the broad sense, the Air Force community includes all of the people, facilities, and services, making up the United States Air Force, and is similar in that sense to such terms as the "scientific community," "legal community," or the "education community." In a narrower sense, the term can apply to a local Air Force installation, especially an Air Force base, since it is set apart from the surrounding civilian community. In this book, we refer to the Air Force community in both senses. In later chapters, when such subjects as career and educational opportunities in the Air Force are discussed, we are using the Air Force community in its broadest sense. This chapter, however, is on the Air Force community as portrayed by the typical Air Force base.

Should you become a member of the United States Air Force, your professional and much of your social life will revolve around the base to which you are assigned. You may actually live on the base; you will do a large part of your shopping for food and other necessities there; and, most important, you will work on the base and accomplish the goals that you have set for yourself.

BASE COMMUNITY SERVICES

In addition to directly supporting the Air Force mission, nearly all air bases provide their personnel with numerous services and facilities. The Air Force believes that people are its most important asset. To be effective, these people need to have not only the tools of their trade—airplanes, missiles, weapons, and all other strictly military equipment and facilities—but also those facilities necessary for their health and comfort. The Air Force recognizes these needs and, as far as possible, provides Air Force families with conveniences and services similar to those in civilian life. Primary attention is given to the basic needs—food, shelter, and clothing. The Air Force also provides up-to-date educational facilities, guidance in spiritual and legal affairs, and a variety of recreational and social programs.

Food and Clothing

Military personnel and their families purchase many items at base facilities. Most on-base shopping is done at the commissary and the base exchange, popularly known as the BX. The use of

these facilities is limited to active and retired members of the armed services and their immediate families.

Commissaries are similar to civilian supermarkets. They carry a full line of the most popular brands of groceries, produce, meat, dairy products, frozen foods, bakery products, and an equally complete line of household items such as cleaning supplies and paper goods. If you think of the **commissary** as the Air Force supermarket, then you might view the **base exchange** as the department store of the Air Force. At the BX, Air Force customers can purchase merchandise not provided by the Government (Fig. 9). Included are some items of clothing, magazines, a certain amount of hardware and appliance items, photographic equipment, sports equipment, and jewelry at prices usually lower than those in civilian stores. The typical base exchange also has a barber shop, a beauty shop, a shoe repair shop, a radio and TV repair shop, a watch repair shop, and a tailor shop.

The base exchange operates at a small margin of profit, but all such profits remain within the Air Force where they are used for welfare and recreational purposes.

Bases provide facilities that offer complete meals or short orders at almost any time of the day. You may find a snack bar in the BX or a cafeteria near the flight line for the convenience of pilots, air crew members, and passengers. Other places to eat on a typical

Figure 9. A modern base exchange.

air base are the dining halls and open messes (officers' club, noncommissioned officers' club, and airmen's club), which also offer a number of recreational and social activities to members and their families.

Billeting and Housing

Almost all air bases provide housing for both single and married personnel. Single personnel are furnished living quarters **(billeting)** in dormitories that offer privacy and modern conveniences. Family quarters range from single family houses to multifamily apartment buildings (Fig. 10). The base housing office assigns family quarters to both commissioned and noncommissioned officers, normally dividing the quarters available equally between them. It also maintains a listing of houses for sale or rent off base. This information is for use when on-base housing is not available.

Most air bases provide guest houses for overnight accommodation of members of immediate families or friends of military personnel. The guest house also offers economical housing until newly assigned personnel locate homes for their families.

Health and Medical Services

Although medical, dental, and hospital care is not a part of a military man's base pay and allowances, it is another benefit provided by the Air Force. Large bases have hospitals (Fig. 11),

Figure 10. Family housing, Craig AFB, AL.

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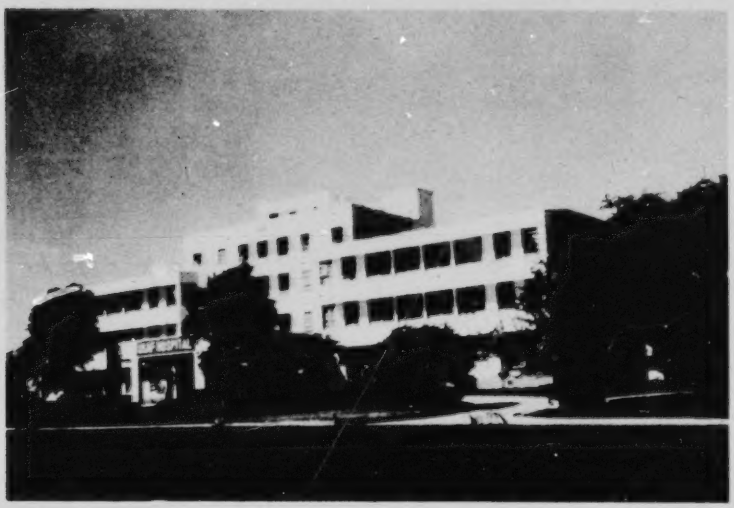

Figure 11. USAF base hospital.

and the smaller bases have at least a small treatment facility **(dispensary)** with an assigned physican and medical technician. For isolated detachments, the Air Force contracts with civilian physicians and dentists for professional services. Military personnel must have periodic medical and dental examinations and, if treatments are necessary, base physicians and hospitals provide the necessary services. The base hospital also provides complete medical care for dependents of military personnel. Only a small fee, to cover the cost of food, is charged while dependents are hospitalized. Financial assistance is available for care of dependents when Air Force facilities are not available. Usually routine dental services are not authorized for dependents within the United States.

Personnel Services and Base Activities

People in a base community are just as varied in their backgrounds and interests as people in any other community. They work, relax, they go to church, and they sometimes have problems and troubles. They seek comfort, they like to be recognized for their work and effort, and they want security in an atmosphere of law and order. In most respects, they are just like people everywhere. On the other hand, there is one essential difference that sets people on an air base apart from those in a civilian community. They live and work on the base for one specific purpose—the

mission of the base. The entire atmosphere of the base focuses on what the individual can contribute to that mission. At the same time, the base provides numerous personal services and sponsors activities designed to assist military personnel with their personal plans. It also helps them to solve problems that may reduce their effectiveness on the job.

On almost every air base, educational and religious facilities occupy a prominent place. Education offices, elementary schools, college classrooms, and even high school buildings are not unusual sights on an Air Force base. A base education office administers the Air Force education services program. Through this office, a service man can arrange to take correspondence courses related to his specialty, or perhaps take college courses either on base or at a nearby college or university. The **base education services officer** gives professional guidance and advice about education opportunities.

Religious activities on an Air Force base closely parallel those in a civilian community. In the base chapel, chaplains of the Protestant, Catholic, and Jewish faiths conduct services and ceremonies according to their faith or denomination (Fig. 12). In addition to conducting weekly and Sunday services, they hold services for men in hospitals or under restriction. Although a chaplain for all faiths is not found on every base, the base commander is responsible for providing religious coverage for all faiths. This responsibility often

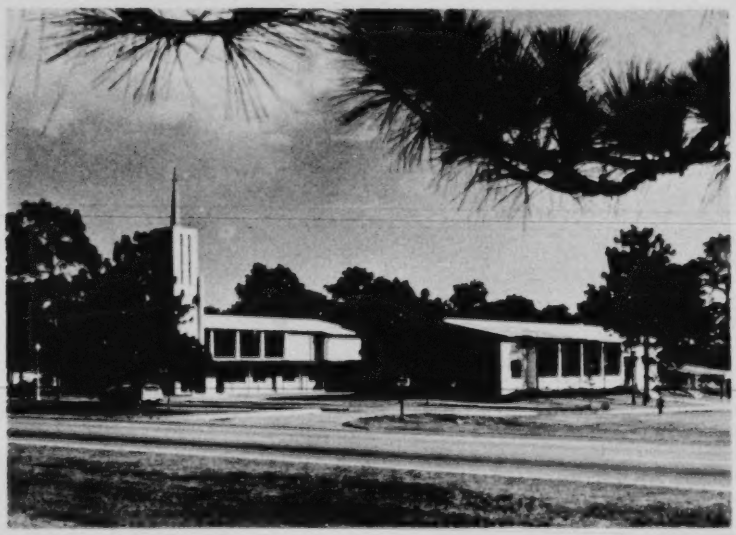

Figure 12. Chapel #3 at Eglin AFB, FL.

requires the cooperation of religious leaders in the civilian community and the use of their facilities.

The typical air base has legal officers who assist military personnel and their dependents with their personal legal problems. At one time or another, most military personnel need legal assistance and advice on such matters as rental contracts, wills, powers of attorney, and other problems of a legal nature. The **legal officer** is a licensed attorney qualified to assist in the preparation of legal papers and claims, but he cannot represent military personnel before a civilian court.

The Air Force member can expect changes in assignments to jobs with greater responsibilities or assignments to a new base. He may occasionally find himself separated from his family. For this reason, he needs advice and guidance on a number of items vital to the welfare of his family and his own security. The **personal affairs officer** gives information and assistance on such items as insurance, casualty benefits, absentee voting, and financial assistance. The personal affairs officer also provides information about living conditions in overseas areas where Air Force personnel are stationed.

Casualty assistance consists of aid to dependents of deceased and missing personnel in settling financial and other problems. In the event of a casualty, an official representative from the nearest Air Force base counsels a serviceman's family regarding their rights and privileges and assists in filing claims.

The **Family Services program** provides help to Air Force families when they report to a new base for assignment. Some Family Services loan furniture and kitchen equipment to new families until their own household goods arrive. Additionally, this office may keep a list of available babysitters and household help.

A frequent remark among Air Force people is the statement, "The Air Force takes care of its own." An official organization of the Air Force, the **Air Force Aid Society,** gives emergency financial assistance to Air Force personnel and their families. This is an organization managed by Air Force people for Air Force people, and it supplements the emergency relief work of the American Red Cross. Its working capital comes from its annual fund-raising drive, conducted Air Forcewide, and from other sources such as contributions from Air Force officers clubs and NCO clubs and from civilian businesses and proceeds from special shows and athletic events. The society has two primary functions: to supply emergency funds to Air Force people who need them and to help Air Force children improve their education. The Air Force Aid Society also offers financial assistance for emergency leaves and for emergency medical, dental, and hospital care.

Recreation and Social Services

The Air Force provides social and recreational activities for military personnel and their families. Most bases offer a wide variety of facilities for these purposes. There are hobby shops, movie theaters, a library, a gymnasium, picnic areas, bowling lanes, and other facilities for the enjoyment of leisure time. Many bases have golf courses. Bases also sponsor athletic programs. Baseball, basketball, bowling, softball, football, and other sports for military personnel and their dependents are common at most bases.

The open messes (officers' club and noncommissioned officers' club) sponsor much of the social and recreational life on the base (Fig. 13). Most eligible Air Force members join because the open mess serves both as a social club and community center. In addition to maintaining dining rooms, the clubs offer a continuing program of dances, parties, dinners, and other forms of entertainment. Many have swimming pools and tennis courts. The wives of members are usually organized into auxiliary clubs. They participate in a number of activities, such as study groups, art classes, and welfare projects. Finally, the club is a pleasant place to entertain guests. Service clubs are operated for those airmen who are not eligible for membership in open messes on the base. These clubs provide entertainment and social activities that appeal to the younger unmarried personnel of the base.

Figure 13. Noncommissioned Officers Club.

Figure 14. Base headquarters.

THE FUNCTIONS OF AN AIR FORCE BASE

Every Air Force base has a commander for those units engaged in carrying out the primary mission and a base commander who is responsible for the operation of base facilities in support of the primary mission. Civilians are sometimes confused by the presence of two (or more) commanders on a base. It is especially difficult for them to understand how there can be a general officer on a base which has a colonel as base commander; they expect the highest ranking officer on the base to be base commander. In practice, however, as pointed out above, the base commander is usually the commander of an air base group or wing which is responsible for providing all of the support functions for the base ("housekeeping duties"). He enables the commander of the primary mission to devote his full time to his specific responsibility and frees him from the task of providing essential services.

The base commander's office is located in the **base headquarters** building, which is the center of base support functions (Fig. 14). Base headquarters serves much the same purpose as city hall in a civilian community. It is the seat of government for the base.

Headquarters and Command

Although the **base commander's** specific duties vary with the size of his command, his responsibilities cover the entire base. His responsibility extends upward to the wing commander, or other higher headquarters that assigned the mission, downward to the officers, airmen, and civilian personnel that carry out the support mission, and outward to the civilian community and to other bases of the major command to which his base is assigned.

Just as a base headquarters is comparable to city hall, so the functions of the base commander and his subordinate commanders are comparable to the functions of city officials. The base commander does not personally accomplish all the workload associated with the operation and management of his base, of course. He relies on his team of specialists and on the commanders of subordinate units who are responsible for the missions and workloads assigned to them. For example, the commander of the security police squadron is comparable to the chief of police in a civilian community. He advises the base commander regarding security police activities and is in charge of insuring the safety of those who live and work on the base.

The **base civil engineer** is also a special assistant to the base commander. His organization provides fire protection; maintains buildings, runways, roads, and other properties; and provides many other services such as plumbing, sanitation, and electrical

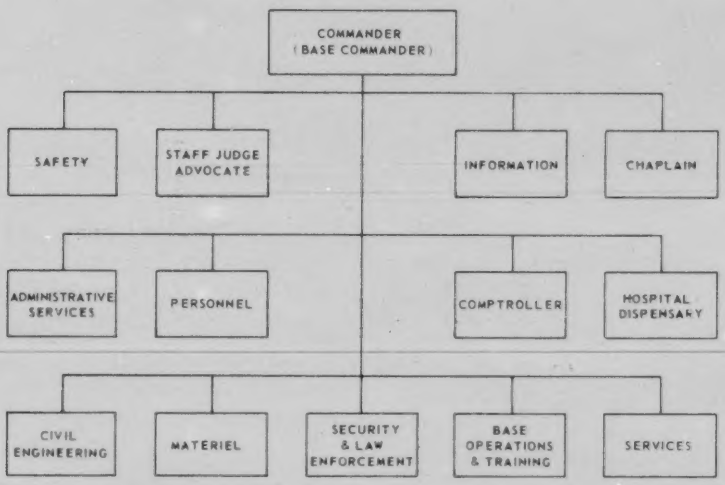

Figure 15. Wing or base organization (support).

Figure 16. Base operations and surrounding area.

services. Each of the blocks shown on the organization chart, Figure 15, represents a specialized activity of the base commander's support team.

The commander of the primary mission organization has his own team whose efforts are devoted to the actual flying, teaching, or other assigned tasks. This team also includes those persons working in direct support of the primary mission. For example, when the primary mission involves flying activities, aircraft maintenance personnnel are normally assigned to the primary mission organization.

The base commander and members of his organization work very closely with the primary mission organization to insure that the right amount of support is provided at the time it is needed.

Base Operations

The focal point of airfield activities on the base is base operations, popularly known as "base ops" (Fig. 16). **Base operations** is the center of all the flying activities on the base and performs tasks to insure the safe and successful execution of all flights. One such task is providing the information needed by every pilot in developing the flight plan he must submit before takeoff. A flight plan usually includes the type of aircraft, pilot's name, points of departure and destination, route of flight, cruising altitude, true airspeed, and other pertinent information.

The **weather section** and dispatch center assist pilots in developing flight plans. The weather observer furnishes current information on weather conditions to regulate landings and departures. The weather forecaster prepares forecasts tailored to the information needs of each pilot on both long and short flights. Weather service is not limited to flying activities; it is available for any official purpose.

The **dispatch office** handles all flight clearances and serves as a base flight information center for everything except weather. The flight clearance is an authorization for aircraft to depart an airfield or to fly a given route under designated conditions. When a pilot has completed his clearance form, the dispatch office coordinates the clearance with air route traffic control centers that monitor the aircraft during its flight.

In the areas surrounding the dispatch office, a pilot finds radio data, flight information, instrument and landing system charts, pilot's information files, and information concerning navigation aids. The dispatch office also provides information on local flying regulations, aircraft parking, and active runways. In addition to pilot information, the dispatch office keeps records of current aircraft arrivals and departures. This information is usually posted on aircraft logs and flight information boards.

The **control tower** regulates the flow of air traffic both in the air and on the ground and provides navigational assistance to

Figure 17. Control tower.

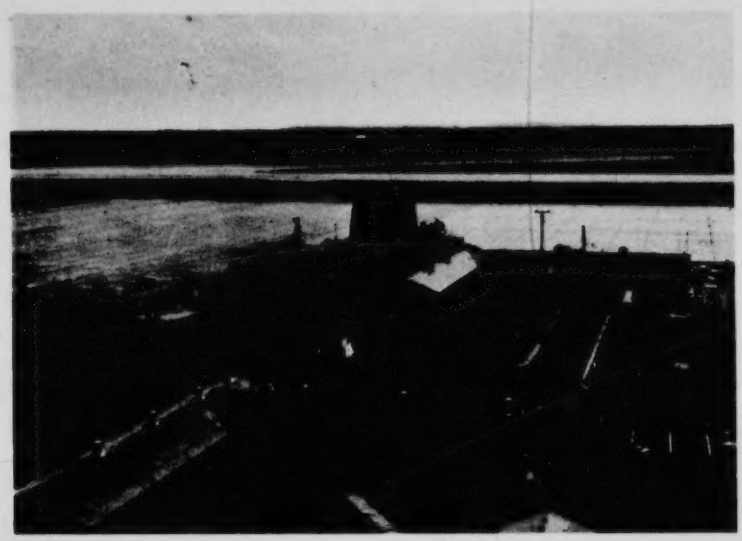

Figure 18. Flight line, fire-fighting stations, and ramp area.

aircraft in flight (Fig. 17). Control tower operators furnish landing instructions and grant landing and taxi clearance to aircraft. They provide pilots with takeoff and landing information, current weather conditions, and air traffic situations. They also relay flight plans and control special radio frequencies, and they may take position reports from aircraft passing over or near their base. Control tower operators also coordinate with radar approach control to assist pilots in landing during bad weather or limited visibility.

Other functions include services for aircraft, such as refueling and fire fighting. Although base operations does not control the petroleum, oil, and lubrications section (POL), the POL function is closely allied with base operations and is a part of flight operations. The base POL provides fueling service for base and transient aircraft (aircraft temporarily stopped, but passing through to another destination). The base fire and rescue station also provides fire-fighting service with specially designed fire trucks, fire-fighting equipment, and trained crews prepared for immediate action (Fig. 18).

These are only a few of the many functions necessary for conducting flight operations on a typical air base. Add to these functions the retraining of pilots, care of transient aircraft, control of personal and mechanical equipment, and other functions necessary for coordinating the flight of aircraft and you have some idea

of the responsibilities and activities of a modern base in support of flight operations.

Maintenance Activities

The operation of an air base requires a great deal of complex machinery and equipment, not only for the aircraft, but also for the administrative, industrial, and community support facilities. Consequently, maintenance in all these areas is a large-scale operation.

AIRCRAFT MAINTENANCE.—Maintenance requirements for aircraft vary with the mission of a given base or with the aircraft assigned to the base. For example, maintenance activities at a fighter or bomber base are primarily concerned with keeping a fairly large number of aircraft ready to fly. On the other hand, similar activities on a transport base are usually concerned with the task of keeping a smaller number of planes in shape to fly a maximum number of hours on regular schedules.

As aircraft change, so do maintenance facilities. Maintenance hangars for the single-engine planes used in World War I were mere huts compared with modern maintenance hangars (Fig. 19). To accommodate the large planes now in the Air Force inventory, many hangars have slots that cover only the front portion of a plane and provide partial protection to maintenance personnel and

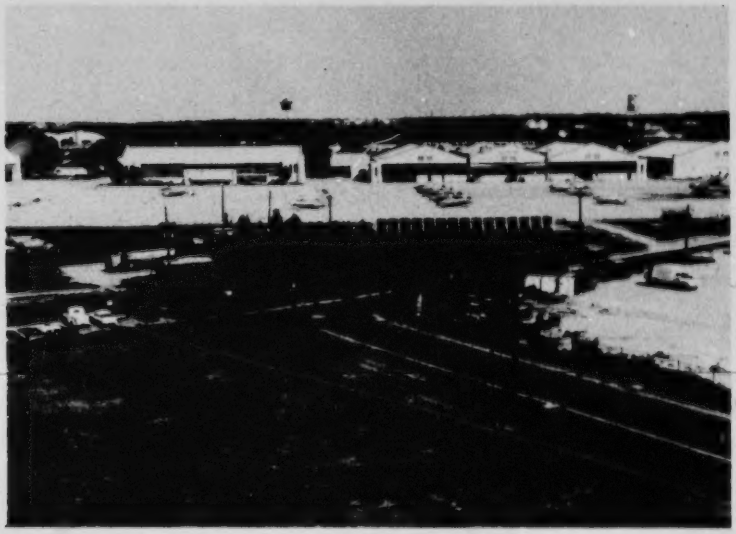

Figure 19. Maintenance hangars and parking ramps.

equipment. Each change produces entirely new requirements for maintenance personnel and new techniques.

The Air Force uses systematic planning and control for aircraft maintenance. This activity includes preventive maintenace and numerous inspections at regular intervals or after a specified number of flying hours. For some categories of major overhaul and specialized repair work, a base may rely on special depots, known as air materiel areas, which are located throughout the United States. Sometimes civilian industries make structural changes to particular models of aircraft on a contract basis.

The following list of maintenance shops found on a typical base will give you an idea of the many and varied maintenance jobs necessary to keep aircraft flying:

machine
metal
structural repair
paint
survival equipment
propulsion
reciprocating engine
jet engine
airborne communications equipment
fuel systems
instrument systems
wheel and tire
egress (escape) systems
aerospace ground equipment
munitions maintenance
armament and electronics
inflight refueling
parachute
propeller
electrical systems

Each of these shops performs many complex and very important functions, the details of which would require far more space than we have available. For example, the armament and electronics shop at regular intervals inspects and tests all components of weapons fire control systems, airborne missiles, and electronic equipment used on modern aircraft.

The work done in these shops also illustrates the impact of changing technology on aircraft maintenance activities. For instance, the advent of jet aircraft has greatly reduced the workloads of propeller shops. On the other hand, the work of jet engine shops has greatly increased. Work in parachute shops has increased because of the use of drag chutes as braking devices on fast jet aircraft.

OTHER BASE MAINTENANCE.—In addition to aircraft maintenance, it is necessary to maintain buildings, runways, streets, motor vehicles, utilities, and other base facilities. The base civil engineer is responsible for all real property and the proper functioning of all facilities on the base. Runways are subject to damage from both the weather and the weight of heavy aircraft. Paved areas, floors of hangars, streets, and drainage ditches must be maintained.

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Refrigeration systems and cold storage plants must be kept in operation. The ordinary utilities—heat, light, and water—must function properly. In addition to his responsibilities for keeping all base structures and facilities in operating condition, the civil engineer is responsible for the largest assortment of maintenance equipment, supplies, and shops to be found on an air base. Such equipment ranges from paint brushes to bulldozers. His shops are scattered throughout the base working area and include carpenter shops, paint shops, sheet metal shops, and a number of others, all performing functions necessary to assure smooth operation of the base.

Base Security and Safety

An air base depends upon safety and security specialists for the enforcement of laws and the protection of individuals. The internal security system on an air base is designed to maintain law and order and to provide full protection for personnel, facilities, and information. In wartime, security from enemy action is particularly important, but, even in peacetime, there are air bases and areas of bases where sabotage and espionage can severely endanger the security of the United States. For example, damage to, or destruction of, aircraft, runways, fuel storage, communications, or power systems can stop base operations at a critical time. If an enemy gained access to certain classified information, critical damage to national defense and security could be the result. Thus, a common sight at all air bases is the security policeman. On many bases, security police are accompanied by specially trained sentry dogs.

The primary role of the **security police** is to maintain law and order and to protect the base against unauthorized persons and activities. Much like their civilian counterparts, the security police also provide guidance and assistance when it is needed. Security measures on a typical air base are apparent in a variety of instances—a security policeman standing guard at a parked plane, regular patrols of flight line and shop areas, and gate guards checking passes at entrances to a base or to restricted areas within a base. The degree and type of protection varies with the mission of a particular base.

Generally speaking, security police have two broad categories of functions and responsibilities—safety and security. A fundamental responsibility of the security police is the enforcement of base traffic regulations and promotion of ground safety. Their major concern is the prevention of accidents. They give frequent lectures and demonstrations to base personnel, place safety posters at key points on the base, and publish articles on accident prevention in the base newspaper.

Throughout a typical air base, security police protect vital buildings and places that contain documents, equipment, or other things that could endanger national security if information about them were to fall into enemy hands. One area may be fenced off, another boarded up, or another protected by lights. People may need special authorization to enter certain areas. The security police protect people and facilities both for their own sake and for the sake of the Air Force mission.

Communications

The **base message center** and the **communications center** are two complementing channels through which communications reach operating units and individuals. Many letters, bulletins, regulations, and other communications pass through base message centers. Here, incoming messages are routed to staff sections and to message centers of individual units on the base. From these centers the material goes to the office, shop, or individual addressee. Outgoing letters, reports, and other material are sent in reverse order up the line to the message center for distribution. The communications message center is the principal channel for messages coming from higher headquarters and other bases. As it receives teletype and radio messages, the center passes them on to units or individuals by telephone or through the base message center and sometimes by both methods. Air bases make use of many kinds of communications facilities involving the most modern equipment.

Transportation

On-base transportation is handled by a base motor pool, which provides various types of vehicles. The **motor pool** is actually a large area where all Air Force vehicles, such as cars, buses, and pickup trucks are stored, maintained, and fueled. The motor pool has one primary purpose—to furnish motor transportation for official use wherever and whenever it is needed. Base bus systems, for example, provide scheduled transportation for personnel.

Base vehicles are not limited to administrative or commercial types, such as sedans, pickup trucks, and trucks for road hauling. There are specialized vehicles such as bomb service trucks, forklift trucks, and even heavy-duty cranes for hangars and maintenance shops. Differences in mission and facilities of an air base determine to a great extent the types and numbers of vehicles assigned to the base.

Base Supply

Base supply is a centralized agency for ordering, storing, and distributing equipment, parts, and other items for use on the base. Thousands of items are handled by base supply. They include all types of supplies from paper and pencils and spare parts for lawn mowers, to rocket engines.

The items handled and the types of warehouses used vary from base to base according to missions. Many of the supplies needed for the space facilities at Vandenberg Air Force Base, California, differ from those required at Keesler Air Force Base, Mississippi, where the Air Training Command has its communications and electronics schools. Yet, the methods used to obtain, store, and distribute supplies are the same at all bases. A skilled supply specialist can perform his work with confidence and efficiency at any base. He anticipates future needs and insures that whatever is needed will be on hand when the need arises.

LOCATION AND DISTRIBUTION OF AIR BASES

We have considered the air base as an organized, self-contained community. We also have examined many of the routine functions performed on a typical base and the varied services that a base offers to the people who carry on these functions. Have you ever wondered how the Air Force determines the location of bases and the number of bases required for it to accomplish its mission? Let us now look at the worldwide base network and the role of this network in relation to the Air Force mission. The network extends into almost every state in the United States and into many areas overseas. Although all bases have similarities, their mission and location have a direct influence on the way an Air Force member lives and works on a particular base.

The Air Base System

If you look at Figures 20 and 21, you can see the widespread geographic distribution of bases throughout the United States and overseas. Prior to World War II, air bases were concentrated in the coastal and southern regions of the United States. Today's bases are much more widely dispersed, partly because modern technology has reduced the importance of fair weather for air operations. Also, advancements in aerospace weapons require air defense for the entire country, not merely coastal and border areas. Furthermore, air bases are no longer limited to the continental United States; they now operate under a global concept of aerospace.

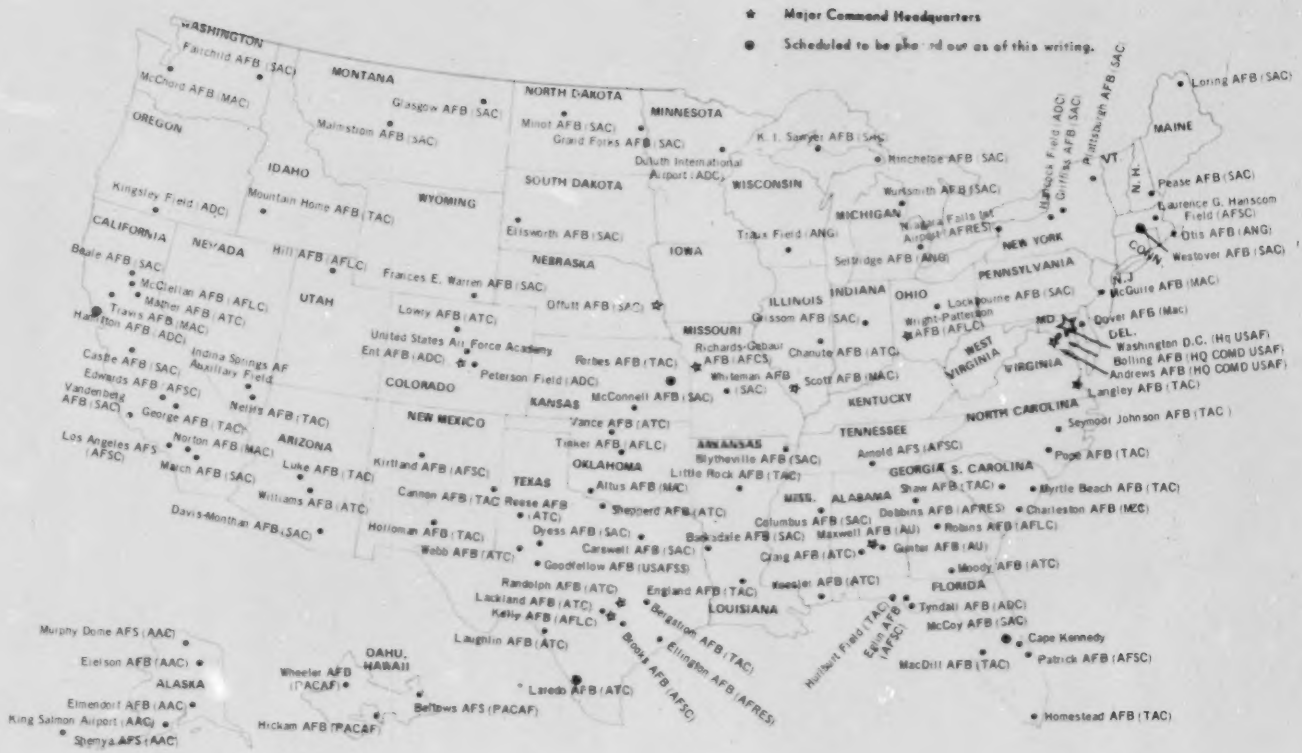

Figure 20. Major active Air Force Bases in the United States, 1973.

AZORES
Lajes Field (MAC)

CANADA
Goose AB (SAC), Labrado

CANAL ZONE
Albrook AFB, Hq USAF Southern Command (USAFSO)
Howard AFB (USAFSO)

CRETE
Iraklion AS (USAFSS)

GREECE
Athenia Airport (USAFE)

GREENLAND
Sondestrom AB (ADC)
Thule AB (ADC)

GUAM
Andersen AFB (SAC)

ICELAND
Keflavic Airport (ADC)

ITALY
Aviano AB (USAFE)
San Vito dei Normanni AS (USAFE)

JAPAN
Fuchu AS (PACAF)
Misawa AB (USAFSS
Tachikawa AB (PACAF)
Yokota AB (PACAF)

JOHNSTON ISLAND
Johnston Island AB (PACAF)

NETHERLANDS, THE
Camp New Amsterdam AB (USAFE)

OKINAWA
Kadena AB (PACAF, SAC)

PHILIPPINE ISLANDS
Clark AB (PACAF)

PUERTO RICO
*Ramey AFB (MAC)

SOUTH KOREA
Kwangju AB (PACAF)
Kunsan AB (PACAF)
Osan AB (PACAF)
Taegu AB (PACAF)

SPAIN
Moron AB (USAFE)
Torrejon AB (USAFSS)
Zaragoza AB (USAFE)

TAIWAN
Ching Chuan Kang AB (PACAF)
Shu-Lin-Kou AS (USAFSS)
Tainan AS (PACAF)
Tapei AS (PACAF)

THAILAND
Korat AB (PACAF)
Nakhon Phanom RTAB (PACAF)
Upon Airfield (PACAF)
Udorn Airfield (PACAF)
U-Tapao Airfield (SAC, PACAF)

TURKEY
Ankara AS (USAFE)
Incirlik AB (USAFE)
Izmir (USAFE)

UNITED KINGDOM
High Wycombe AS (USAFE)
RAF Olconbury (USAFE)
RAF Bentwaters (USAFE)
RAF Chicksands (ULSAFE)
RAF Lakenheath (USAFE)
RAF Mildenhall (USAFE)
RAF Sculthorpe (USAFE)
RAF Upper Heyford (USAFE)
RAF West Ruislip (USAFE)
RAF Wethersfield (USAFE)
RAF Woodbridge (USAFE)

WEST GERMANY
Bitburg AB (USAFE)
Erding AS (USAFE)
Frankfurt (USAFSS)
Hahn AB (USAFE)
Lindsey AS (USAFE)
Ramstein AB, (Hq USAFE)
Rhein-Main AB (USAFE)
Sembach AB (USAFE)
Spangdahlem AB (USAFE)
Tempelhof Airport (USAFE)
Wiesbaden AB USAFE, MAC)
Zweibrucken AB (USAFE)

*Scheduled to be closed as of this writing.

Figure 21. Major USAF bases, installations, and facilities located overseas, 1973.

Air bases in the global system are located and maintained according to current Air Force operating plans. Although, as we have seen earlier, a single base may have more than one mission, every base has a primary function in the global concept of aerospace power. This function may be training, strategic offense, defense, logistics, air transport, or research and development. Together they form a worldwide network to insure the Air Force of a capability to perform specific missions. To be an effective military instrument, the Air Force must be able to maintain continuous action and, to do this, it must have an uninterrupted flow of supplies—fuel, ammunition, replacement parts, personnel, and new aircraft to strategic points. The current system of air bases insures such an operating capability and the continued Air Force support of national policies.

One of the basic military policies of the United States is the strategy of deterrence. The US Joint Chiefs of Staff define **deterrence** as "the prevention from action by fear of the consequences. Deterrence is a state of mind brought about by the existence of a credible threat of unacceptable counter action." For the Air Force to act as a deterrent, it must have strategically located air bases and weapons that can react quickly to an attack upon this nation or any of its allies. In other words, US military strength must be so apparent that potential enemies will realize that they could neither win a war nor recover from the damage they would receive, if they were to launch an attack against the United States.

To be effective, the worldwide system of Air Force bases must be ready for any emergency before it begins. In limited war particularly, bases must be in or near the areas of combat to provide a line of support from air bases in the United States to the combat forces.

An adequate supply of fuel, fighting equipment, replacement parts, and trained men is a necessity for waging modern war. A shortage of any one of these can force a unit out of action. Therefore, the air base system includes installations capable of storing, repairing, and maintaining essential equipment and supplies. Reserve supplies are also stored where they can be reached if the long supply lines to the United States are temporarily cut off.

To man this system of air bases around the world, Air Force personnel usually serve a part of their career overseas. These assignments are, for the most part, pleasant and interesting experiences and afford Air Force personnel an opportunity to visit parts of the world that they might otherwise never see.

Early in an airman's career, he will most likely be assigned to a base in the United States. In fact, he will probably serve at

two or more bases during his first year of service. He will receive his basic military training at Lackland Air Force Base, Texas, and perhaps report to another base for technical training before being assigned to his first duty station.

Representative Bases

Practically every state has at least one Air Force installation. Among the many interesting aspects of Air Force life are the opportunities to live for varying lengths of time in different parts of the United States and to become acquainted with the areas and the people. To give you some idea of Air Force life on a typical air base in the United States, we have selected three bases in different sections of the country with representative missions and facilities. As you read, notice how the activities of one base differ from those of another base according to its mission. At the same time, notice the extent to which each base provides services for military personnel and their families.

McCHORD AIR FORCE BASE, WASHINGTON.—This base is one of several military installations located just south of Tacoma; others include Fort Lewis and Madigan General Hospital. It is a Military Airlift Command (MAC) base and provides worldwide strategic airlift services for the Department of Defense. The base also provides support to the 25th Air Division of the Aerospace Defense Command (ADC). Aircraft on McChord Air Force Base are primarily heavy transports and fighter-interceptor jets.

The Pacific Northwest is a sportsman's paradise. Tacoma's harbor and the saltwater Narrows of Puget Sound are ideal for fishing. There are numerous fresh water lakes within easy reach, sandy beaches for swimming, and open waters for outboard motoring. Along the shoreline of Puget Sound are 2,000 miles of forestland for camping and hunting. Some of the best skiing areas in the country are easily accessible. The climate of the area ranges from an average of 64 degrees in summer to a winter average of 40 degrees. Snow is a rare occurrence.

Both Tacoma and Olympia offer theaters, public meeting places, churches of many faiths, shopping facilities, and schools. There are more than 1,000 family housing units on base for married personnel. The University of Puget Sound and Pacific Lutheran University offer a variety of off-duty educational opportunities ranging from courses in typing, crafts, and aeronautics to master's degree programs. Two elementary schools are located on-base, and excellent junior and senior high schools are located nearby. The McChord Family Service Center helps new arrivals to locate houses or apartments and even maintains a lending closet for homemakers to borrow emergency kitchen equipment until their

household goods arrive. Both McChord and nearby Fort Lewis have commissaries, beauty shops, cafeterias, and service stations. Recreational facilities include heated swimming pools, craft shops, golf courses, bowling lanes, tennis courts, little theaters, and a variety of other activities.

VANDENBERG AIR FORCE BASE, CALIFORNIA.—Camp Cooke, bordering the Pacific Ocean in northern Santa Barbara County, California, was originally the training ground for US armored divisions during World War II. After the war, it was abandoned to hunters and fishermen. With the coming of the missile age, however, a board of Air Force officers selected the 65,000 acre tract of what was Camp Cooke as the site for the first intercontinental ballistic missile force. One reason for the selection of this site was that the terrain and geographic isolation provided suitable safety features for launching experimental missiles. Another favorable feature was that this site is near the Air Force Ballistic Systems Division and much of the aerospace industry in and around Los Angeles. It is also ideal for launching polar-orbiting missiles and satellite boosters that can reach Antarctica without passing over land areas.

Thus, Vandenberg Air Force Base became in a sense a missile city. Today, it is a major installation of the Strategic Air Command (SAC). It is the only location from which the Air Force normally launches intercontinental ballistic missiles during peacetime. It is here that SAC evaluates its entire force of ICBMs and trains missilemen. This base serves also as a research center for the Air Force Systems Command to conduct missile tests and space programs. Because it has such a diversity of testing and training programs, Vandenberg Air Force Base depends to some degree on almost all Air Force supporting services ranging from group components of the Air Force Logistics Command (AFLC) to small field detachments of the Air Training Command (ATC). Also located at Vandenberg are units of the National Aeronautics and Space Administration (NASA), the Army and Navy, and a number of industrial contractors.

The beaches, which comprise almost one-fifth of Santa Barbara county's coastline, are among the area's finest recreational assets. Freshwater lakes and public parks are easily accessible for boating, water-skiing, fishing, and camping (Fig. 22). Surrounding Vandenberg is a community that sponsors many social events each year ranging from water carnivals to clam festivals. As an aerospace crossroads, Vandenberg is a modern community; yet, many of its tangled backlands are the same today as they were when the Indians sent their tribal messages down the rugged coastal canyons.

Figure 22. Saddle club at Vandenberg AFB, California.

Military personnel assigned to Vandenberg Air Force Base have the added advantages of both a good educational system and housing accomodations both on- and off-base. On the base itself, the California public school system provides four elementary schools and a junior high school. High school students attend public or parochial schools either in Vandenberg Village, five miles from the base, or in the nearby towns. Allan Hancock College and the University of California offer undergraduate and graduate degrees in on-base classes held in the evenings and on Saturdays. On base, there are numerous houses and trailer spaces. Vandenberg leases additional houses off-base for military personnel. Approximately 75 percent of Vandenberg's members live off base either in rental quarters, Government leased homes, or in homes of their own.

LANGLEY AIR FORCE BASE, VIRGINIA.—Langley Air Force Base is the oldest continuously operated facility in the Air Force, and, at the same time, it is one of the nation's fastest growing, most important air bases (Fig. 23). Located on the Virginia Peninsula, Langley is now the headquarters base for the Tactical Air Command (TAC). This major command works in conjunction with ground and naval forces all over the world as one of its

primary missions is to provide tactical air support to active battlefield forces. As the focal point of this command's operations, Langley Air Force Base is one of the busiest military air bases in the nation with more than 12,000 take-offs and landings on its two large concrete runways every month. These runways support aircraft ranging from supersonic jet fighters, interceptors, and bombers to the huge assault aircraft transports.

Like most air bases, Langley Air Force Base is a community within a community. It has several special service shops in addition to a commissary and a base exchange. One notable feature of Langley is its nearness to other military posts and service facilities. Fort Monroe, headquarters of the Continental Army Command, is only 10 minutes away by automobile, and Fort Eustis, headquarters of the Army Transportation Command, is just north of Langley between Hampton and Williamsburg.

Recreational and social facilities at Langley are extensive. Located in the base service office is a modern library of about 30,000 volumes of fiction, nonfiction, and reference works. The base is not far from Chesapeake Bay and its tributaries, which are excellent for swimming, boating, and fishing. Langley has its own yacht club for military personnel and, for those who do not own boats, a special services section maintains boats for use by groups or individuals. In the field of education, Christopher Newport College conducts classes on a new campus in Newport News; Hampton Institute in Hampton and Old Dominion College in Norfolk offer four-year liberal arts and engineering

Figure 23. TAC aircraft parked on the flight line at Langley AFB, Virginia.

courses. Both the University of Virginia and George Washington University offer graduate courses on base.

Overseas Bases

Overseas Air Force bases and installations extend from the Arctic to the Antarctic and from Europe to various points in Asia. (Refer to Figure 21.) A member of the Air Force may be assigned to one or more of these bases during his career.

When possible, the Air Force allows the families of its members to accompany them on overseas tours. For the most part, life on an overseas base is similar to that on bases within the United States. The length of time spent in an overseas assignment varies according to the location and whether or not dependents can be there. In Korea, for example, the tour is 13 months if the member is not accompanied by his dependents—two years with dependents. On the other hand, in Germany the tour with dependents usually is four years, or two years without them.

Overseas bases follow about the same pattern of organization as bases in the United States. The specific mission of each base determines its operational functions, but the supporting functions are the same whether the base is located in Alaska, the Pacific, or Europe.

An overseas assignment provides an excellent opportunity to travel. In Europe one is able to travel throughout the continent. Likewise, in the Orient, trips and tours are available to many countries and islands. Another attraction of living overseas is the opportunity to become closely acquainted with people of other cultures and to participate in their recreational and social life.

WORDS AND TERMS TO REMEMBER

community
commissary
base exchange
billeting
dispensary
base education services officer
legal officer
personal affairs officer
casualty assistance
Family Services program
Air Force Aid Society
open mess
base headquarters
base commander
security police
base civil engineer
base operations
weather section
dispatch office
control tower
message center
communications center
motor pool
base supply
deterrence

REVIEW QUESTIONS

1. **What community services are provided for Air Force personnel?**
2. **Describe the duties of a personal affairs officer.**
3. **Describe three functions of base operations.**
4. **List some of the maintenance shops found on a typical Air Force base.**
5. **What are the functions of the security police?**
6. **What is the function of base supply?**
7. **How are communications handled on an Air Force base?**
8. **What is the strategy of deterrence? How does it affect the location of Air Force bases?**
9. **Name the primary missions of the representative bases mentioned in this chapter. (McChord AFB, Langley AFB, and Vandenberg AFB).**

THINGS TO DO

1. Visit your local city government and make an organizational chart showing the various officials and their functions. Point out the similarities and differences between the functions of the city officials and those of the base commander and his staff.
2. Arrange to tour a nearby Air Force base and note the activities and facilities provided by the base.

SUGGESTIONS FOR FURTHER READINGS

Air Force Bases. Harrisburg, Pennsylvania: Stackpole Books, 1965.

GLINES, CARROL V. *The Modern United States Air Force.* Princeton, New Jersey: D. van Nostrand Co., Inc., 1963.

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Chapter 3

Air Force Community Relations and Educational Opportunities

THIS CHAPTER covers three major Air Force programs: Domestic Action, Social Actions, and education. The purpose of both Domestic Action and Social Actions are examined and examples of existing programs are described. The chapter then discusses the educational opportunities offered by the Air Force. When you have studied this chapter, you should be able to: (1) define Domestic Action and describe how it operates; (2) define Social Actions and explain the problem areas to which it applies; and (3) name and describe at least three educational programs offered by the Air Force.

A PRIMARY concern of the Air Force is to provide its members with help in solving their problems and with full opportunity to further their education and training. To this end, the Air Force has established effective programs of community relations, education, and on-the-job training.

COMMUNITY RELATIONS

In chapter 2 we pointed out that the word community has a number of meanings. This is true also of the term community relations since the term is applied to many kinds of person-to-person and group-to-group relationships. **Community relations** can refer to the relationships between individuals or groups within a community or it can refer to the relationship between one community and another.

Unfortunately, whatever the type of relationship, social and human problems are likely to arise. Some of these problems can be solved quickly and easily, others are more serious. Undetected and unresolved, they can fester and spread like a deadly disease until they become a threat to the welfare and progress of society.

The problems of society—drug addiction, alcoholism, conflicts between people of differing beliefs or racial background, inequalities in employment practices, to name some of the more serious ones—are a matter of national concern. The Air Force shares in this concern and has established programs designed to uncover the causes of these problems and develop workable solutions.

For discussion purposes, these Air Force programs can be classified as external and internal. The external programs are concerned with relations between the Air Force community and the civilian community. The internal programs are concerned with human relations within the Air Force community. In each area the Department of Defense has initiated a comprehensive program which is being actively carried out by the Air Force and by all other military services. The overall programs for external and internal community relations are called Domestic Action and Social Actions respectively.

Domestic Action

The Air Force has always encouraged its members to participate in the affairs of their neighboring civilian community whether they live on base or off. Many Air Force personnel and their families attend local churches, join civic and fraternal organizations, and take an active part in community projects such as fund-raising drives, welfare work, and patriotic celebrations.

In 1969, the Department of Defense created the Domestic Action Program. In announcing the program, Secretary of Defense Melvin Laird said that through this program, the Department of Defense could play a "significant role" in solving the problems affecting the urban areas of the United States.

Domestic Action operates on the simple premise of people helping people. In other words, service personnel offer their off-duty time, their special skills, and, frequently, facilities and equipment of their military installations to surrounding civilian communities (Fig. 24). An example of Domestic Action at work is a nationwide project called Military Assistance to Safety and Traffic (MAST). In this project, military helicopters are used to send medical technicians to the scene of serious accidents, or other medical emergencies where speed is vital, and evacuate victims to local civilian hospitals. MAST operations are described in the AE II text *Defense of the United States.*

Figure 24. Domestic action at work.

The Domestic Action Program covers six general areas:

1. Procurement—awarding government contracts to minority businesses.
2. Manpower—transition and referral projects by which job-related training and employment programs are provided to help service members find meaningful jobs when they return to civilian life.
3. Transfer of technical knowledge—projects such as MAST, whereby civilian efforts are supplemented by military technical know-how and equipment.

4. Assets—the transfer of defense plant facilities and equipment to the civilian sector of the economy when installations are closed or relocated.

5. Community relations—programs to provide recreation and training to young people. These programs include recreational and educational activities on or near military installations as well as residential and day camps for disadvantaged youths.

6. Equal Opportunity—insuring equal rights and opportunities for service personnel and employees.

The Air Force has developed an increasingly effective and expanding Domestic Action program covering three major areas: education/training, health/medical, and recreation/entertainment. As of 1971, all major Air Force installations in the United States were involved in at least one Domestic Action project.

EDUCATION AND TRAINING.—The Air Force has been particularly active in education programs designed to combat the problems of drug abuse and racial discrimination within our society. At Columbus AFB, Mississippi, a drug abuse education team was formed to educate military personnel and civilian groups on the medical and legal dangers of drug abuse. The team developed a comprehensive 2½ hour briefing which includes presentations from the base staff judge advocate office, the base hospital and the base social actions office. A significant portion of the briefing covers methods parents can use to detect potential or actual drug abuse and how drug abuse can be controlled and stopped.

The Air Force is also very actively engaged in "Crisis Hot Line" programs providing current, factual information on drug abuse, venereal disease, alcoholism, emotional disturbances, suicides, and other social problems, on a 24-hour basis. Every major USAF installation has a **hot line program,** with many bases sharing hotlines with the local civilian community. The hot line programs are tremendously successful in providing needed, factual information and a compassionate listener to solve some very real and immediate personal problems.

Kirtland Air Force Base, New Mexico, has been active in one of the most neglected areas of education. In cooperation with the Albuquerque public schools system, Kirtland provides 110 training stations in support of a vocational special education curriculum for students with learning problems. The students attend school in the morning and work at on-base training stations in the afternoon. The object of the program is to develop vocational skills

for educable, mentally retarded students so that they will become useful and productive citizens.

In an effort to overcome racial discrimination, the Mather Air Force Base, California, Human Relations Council, working with various Sacramento community organizations, has conceived a Federated Community Action Committee. Members of the new committee are drawn from Parent Teachers Associations, the National Association for the Advancement of Colored People, Concillio, the Urban League, and other groups interested in human relations and educational improvements in the greater Sacramento area. The committee was formed to detect issues and tensions in the school or community; the committee will also work toward resolving the problems. Also, the Mather Council has been working with the Folsom-Cardova Unified School District to help the student body form a Human Relations Council. The program is aimed at creating harmonious relations within the community and in averting crises.

HEALTH AND MEDICAL.—With the increasing shortage of qualified people in medicine and related fields, adequate health care is becoming a serious domestic problem. Air Force medical personnel, in conjunction with local communities, have been active in supplementing the medical services available in those communities. As a part of the long-term solution for a shortage of trained medical personnel, the David Grant Medical Center at Travis Air Force Base, California, is working with local schools to provide medical education and experience in fields not otherwise available. The Air Force Anesthesiology Service, in a cooperative program with the University of California, is allowing third- and fourth-year medical students to rotate through the Anesthesiology Service as an approved elective. The students receive approximately 400 hours of instruction in the course. In addition, members of the base hospital staff teach courses in urology, hospital administration, hematology, and various other medical subjects, giving the University faculty an additional depth of medical experience to draw from as teachers.

In a relatively new area of medical research, the Mather Air Force Base, California, hospital is conducting a pilot test program for sickle cell anemia. The base will initially test military personnel, their dependents, and civilian employees. Upon successful completion of the testing programs, Mather plans other screening programs, off-base. Mather's hospital has also been active in dental nurse hygienist and first-aid training programs. The hospital has already conducted first-aid classes at local junior high and high schools for approximately 1,200 students. In addition, Mather has also conducted classes for "Aquarian Effort" counselors at the

Sacramento Community Center. "Aquarian Effort" is a community volunteer organization, designed to help fight drug abuse.

The Air Force is also working with civilian communities to curb and control the Nation's pollution problems. Eglin Air Force Base, Florida, has been working with the Okaloosa County Planning and Zoning Commission in a cooperative effort that has developed a comprehensive development plan for the entire county. The plan includes provisions for improvement in such areas as environment, housing, and transportation. This is the first complete plan for Okaloosa County development and represents a significant first step in the community's effort to control pollution.

Many Air Force personnel are involved in personnel acts of compassion that rarely receive recognition. One such effort involves Air Force personnel at Maxwell AFB, Alabama who perform "personal counseling" services at a Montgomery, Alabama, community walk-in crisis center called "Lighthouse." The center provides legal counseling and psychiatric and other professional medical assistance to troubled individuals. The results of the personal, one-to-one counseling efforts can alter an individual's life and motivate him or her to become a productive member of society.

RECREATION AND ENTERTAINMENT.—Air Force bases continue to provide facilities and instruction for a broad range of activities. One unique form of recreation and entertainment was a Black Arts Festival held at the Air Force Academy at Colorado Springs, Colorado, last year. The festival was a first for any military academy and featured a film festival, soul food in the cadet dining hall, entertainment by black bands, a black fashion show, a black chapel service, and a sculpture display by a black sculptor.

Also active at the Academy and many other Air Force bases are comprehensive **Big Brother programs.** The one-adult-to-one-youngster programs bring fatherless boys from the surrounding communities in contact with Air Force personnel who involve the youths in sports and cultural events. Normally, the youths also become involved with the families of their big brothers, and are exposed to a good home environment. The exposure has had dramatic results in reorienting the youngsters' values and goals.

Many Air Force bases continue their strong support of the Scouting and Explorer programs and engage in a wide variety of off- and on-base scouting activities. Air Force personnel provide experienced mature leadership for these programs. With the help of Air Force equipment and facilities, they present demonstrations on subjects ranging from cooking to supersonic aerodynamics, and help young minds to mature and grow.

These are only a few of the Air Force Domestic Action programs active today. Each day brings forth new challenges for the programs to solve—limited only by the problems faced and the imagination of the people working together to solve them.

Social Actions

Air Force bases are not immune to the "people problems" that trouble civilian communities—problems of human behavior that could seriously damage the accomplishment of the Air Force mission if they were not quickly detected and resolved. The Air Force does just this through its Social Actions Program.

Social Actions, as its name implies, is a program of actions designed to prevent or cure social problems that arise in the Air Force community. A Social Actions Office has been established on every major Air Force installation, and these offices are staffed by Air Force personnel who are trained in social and behavioral sciences.

The approach of the program is to determine the causes of behavioral problems rather than to treat only the outward symptoms. Those who work in the Social Actions program function in much the same way as doctors, who must diagnose the cause of an illness before they can prescribe a remedy.

Working in close cooperation with the base commander, the Social Actions Office of each base involves itself with all segments of the base community, identifies the factors that are contributing to stress or social disorder, and, as far as possible, eliminates or reduces the problem-causing factors as they are identified. Personnel in the Social Actions Office work in close cooperation with the base commander.

Social Actions is a comprehensive program which ranges from education and training, to the rehabilitation of alcoholics and drug abusers, to insuring equal opportunity and treament, not only in job situations, but in housing and military justice.

Above all, the Social Actions program is flexible. No two Air Force bases have exactly the same problems or have problems in the same degree of intensity. The Social Actions Office on each base tailors its program to fit the needs of its particular base.

EDUCATION OPPORTUNITIES

Education has always played an important role in the Air Force but, today, that role is more important than it has ever been. A broad range of courses are open to airmen and officers to further their development in their service careers or to prepare them for employment in their chosen fields if they elect to return to civilian life.

In addition to conducting nearly 4,000 technical training courses, the Air Force provides for the education of Air Force officers through the Air Force Academy, the professional military schools of the Air University, the ROTC program, and the Air Force Institute of Technology. Also, thousands of Air Force personnel further their education on a part-time basis at colleges and schools on or adjacent to many air bases. Others enroll in correspondence courses. A recent development in the Air Force educational program is the Community College of the Air Force (CCAF), established by the Air Training Command in 1972 for the purpose of obtaining broader recognition for Air Force training programs in civilian educational institutions and in the employment field.

Air Force Reserve Officer Training Corps

Air Force Reserve Officer Training Corps (AFROTC) is the primary source of commissioned nonrated officers and a major source of rated officers (pilots and navigators) for the Air Force. The program is offered on the campuses of colleges and universities in 46 states, Puerto Rico, and the District of Columbia. Two commissioning programs are available for college students through AFROTC. Freshmen may enroll in the four-year program and students with at least two years of undergraduate or graduate work remaining may apply for the two-year program. The two programs are open to both men and women (Fig. 25).

Both four-year and two-year cadets attend the **Professional Officer Course** (the last two years of the AFROTC program), but four-year cadets also take the General Military Course (the first two years), which consists of one hour each week in the classroom and one hour in the Corps Training Program (military training and leadership). Classroom instruction time for the Professional Officer Course is three hours weekly, plus one hour in the Corps Training Program. Four-year cadets must complete a four-week field training course during the summer between their sophomore and junior years. Two-year cadets complete a six-week field training course (which makes up for the General Military Course) before entering the program.

Scholarships are available to qualified cadets in both the four- and the two-year AFROTC programs. Each scholarship provides full tuition, laboratory expense, incidental fees and an allowance for textbooks. While all cadets receive a monthly, nontaxable subsistence allowance of $100 in their junior and senior years, scholarship cadets receive this allowance for the whole period of the scholarship.

In either program, there are certain commissioning requirements. The cadet must successfully complete the Professional Officer

Course and field training; must earn at least a baccalaureate degree; must agree to accept a commission in the United States Air Force if it is offered; and must agree to serve for a period of not less than four years on active duty after receiving a reserve commission, (or not less than five years if the cadet is going to become a rated officer-pilot or navigator).

AFROTC cadets who volunteer and are qualified for Air Force pilot training take their first step toward winning their wings through the Flight Instruction Program (FIP) which is given at no cost to the cadet. (Women are not eligible for this program). The

Figure 25. AFROTC cadets at retreat ceremony.

program is given in the year prior to commissioning. It serves as a test of the cadet's aptitude and interest in flying before he attends undergraduate pilot training as an officer (Fig. 26).

Cadets who complete AFROTC and receive a commission may request a delay from entering on active duty to obtain a graduate degree. However, this is done at their own expense. Or they may apply for advanced education at Air Force expense under the **Air Force Institute of Technology (AFIT).**

High school students who have successfully completed at least two years of the Air Force Junior ROTC program may receive credit for a portion of the General Military Course if they elect to enroll in the four-year college ROTC program. An additional advantage of AFJROTC is that each high school with an AFJROTC unit is offered at least one AFROTC scholarship for a cadet who qualifies for the program.

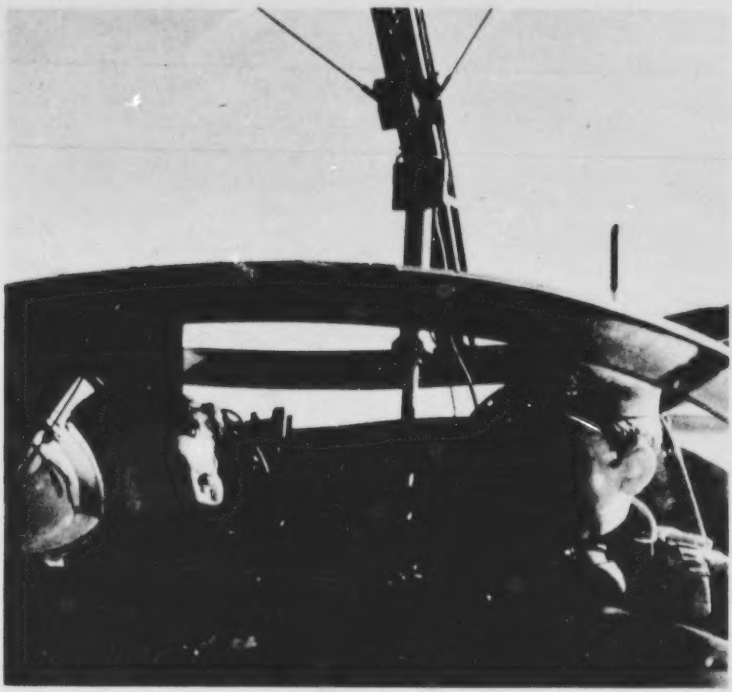

Figure 26. AFROTC cadet discusses panel board of a T-37 with an Air Force pilot.

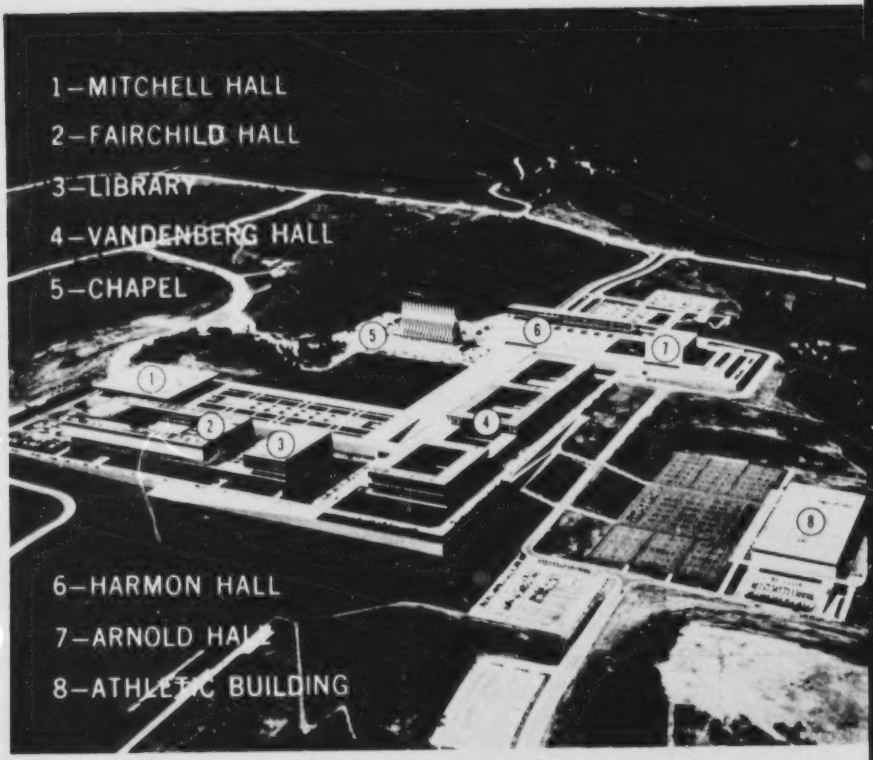

Figure 27. The United States Air Force Academy.

Air Force Academy

The Air Force Academy (AFA), located near Colorado Springs, Colorado, on an 18,800-acre site, ranks among the nation's finest colleges and universities (Fig. 27). Young men appointed to the Academy receive a four-year college education in addition to military and physical training. The academic curriculum consists of both humanistic and scientific studies. Successful completion of the prescribed courses leads to a bachelor of science degree and a commission as a second lieutenant in the Regular Air Force.

By authorization of Congress, the Academy maintains a strength of 4,417 cadets. This equalizes the student strength of the Air Force, Army, and Naval academies.

Most of the yearly appointments to the AFA are made by US Senators and Representatives. The nominees are selected by members of Congress from eligible young men in their states or

districts who have applied for an appointment. Application for appointment to the Academy must normally be made during the year before the applicant wants the appointment—in other words, during his junior year in high school.

Of special interest to AFJROTC students is the fact that three students from each high school may be nominated to compete for authorized vacancies in the AFA. To be eligible, the student must have successfully completed the AFJROTC program at his school and be awarded a certificate of completion and a high school diploma. The aerospace education instructor recommends the best qualified applicants to the high school principal who, in turn, submits the nomination to the Academy.

The eligibility requirements for a prospective appointee are as follows:

1. He must be at least 17 years old and not have passed his 22nd birthday on 1 July of the year he is to be admitted.

2. He must be a citizen of the United States. (This does not apply to Allied students.)

3. He must be responsible, trustworthy, stable, and have good moral character.

4. He must never have been married. Any cadet who marries while at the Academy will be discharged.

5. He must be in good physical condition.

6. He must have a good scholastic record.

7. He must have demonstrated his potential for leadership in extracurricular activities.

8. He must have a strong desire to become a cadet and pursue a military career.

A successful candidate for admission must assume certain obligations and sign an agreement to that effect. He must agree to complete the course of instruction unless disenrolled by competent authority; accept appointment as a commissioned officer upon graduation and serve in one of the armed services for five years; if authorized to resign before the sixth anniversary of his graduation, serve as a commissioned officer in the Reserve component of his service until the sixth anniversary is reached; and, if disenrolled from the Academy, be subject to the separation policies employed by all service academies.

The Air Force Academy offers a comprehensive range of academic courses in addition to leadership and military training, physical education, and athletics. Cadets may select their major from numerous offerings within the fields of science and engineering or social studies and humanities.

The academic program of AFA includes graduate-level courses which may be applied toward a master's degree under a cooperative arrangement between the Academy and various civilian universities in less than one year after graduation. Graduate programs include both science and engineering fields and social sciences and humanities.

In conjunction with the AFA, the Air Force conducts the Air Force Academy Preparatory School for selected members of the Regular and Reserve components of the Air Force and for unsuccessful candidates for AFA whose records indicate that they could improve their chances of receiving an appointment by additional academic preparation. The Preparatory School provides an 11-month course of intensive instruction in English and mathematics to assist students in preparing for the entrance examinations. It also prepares the students for the academic, military, and physical training programs of the Academy.

Community College of the Air Force

One of the most recent educational programs of the Air Force is the **Community College of the Air Force** (CCAF) which was established by the Air Training Command in 1972 (Fig. 28).

Figure 28. Some of the training aids used by the Technical Training Center at Chanute AFB, Illinois.

Although much excellent education was being received by enlisted personnel through Air Force training courses and off-duty education, it was apparent that little credit was being given for their training when they returned to civilian life. Transferring from one base to another also caused difficulties in documenting the completion of educational programs. Airmen who wished to continue their off-duty education at their new base frequently found that the credits they had earned previously were not acceptable at schools near their new location.

The program encompasses all seven major Air Force training schools, including five Air Force Schools of Applied Aerospace Science, the School of Health Care Sciences, and the Security Service School.

The goals of the CCAF are:

- To give everyone entering the Air Force a head start on his or her education.
- To encourage Air Force personnel to program their education toward meaningful career goals.
- To give everyone who leaves the Air Force the credentials for correct educational or job placement.

In December 1972, the Community College was granted affiliate status by the Southern Association of Colleges and Schools, which at that time granted full five-year accreditation to the five Air Force schools within its jurisdiction. The remaining two schools are currently being examined by the North Central Accrediting Association.

Community College programs also incorporate a variety of courses offered by accredited civilian colleges and universities throughout the United States, some 600 of which conduct classes on or near Air Force bases.

The Community College of the Air Force offers each airman the opportunity to earn a Career Education Certificate. A minimum of 64 semester hours is required to complete the Certificate, of which

- 24 semester hours must be in the airman's specialty (earned through Air Force or civilian schools),
- 25 semester hours must be from an accredited college or university (includes courses in the humanities, communicative skills, and the sciences),
- 15 semester hours can be elective (six must be from the field of management).

There are eight major areas (with 76 subdivisions) in which an airman can earn his Certificate:

- Administration and management
- Aircraft maintenance
- Communications
- Crafts and trades
- Distribution services
- Electro-mechanical
- Health care sciences
- Public services

Every airman is encouraged to participate in the Community College program. He or she gets an initial boost of four semester hours credit for the physical education, first aid, and health courses completed during basic training. An airman earns additional semester hours when he completes a course from a School of Applied Aerospace Sciences.

To complete requirements for a Certificate, an airman can register for off-duty classes at his first assignment. If he does, the Air Force pays 75 percent of his tuition. Appropriate civilian courses completed by an airman before he comes on active duty can also be counted.

A centralized and computerized credit bank of each airman's educational progress and achievements is maintained at Randolph AFB. Wherever and whenever an airman completes a course, he can have the results forwarded to the College for documentation on his transcript.

When an airman needs a copy of his transcript, he simply goes to his base education office, fills out a small request form, and forwards it. His transcript is mailed to him without charge. Transcripts mailed to other college or university registrars have the official seal of the Community College of the Air Force embossed on them.

An airman can either take his transcript with him when he leaves the service or write for one later on. The document is easily understood by potential employers, trade unions, or other college registrars.

Other Educational Opportunities

The programs so far discussed are but a part of the educational opportunities available to Air Force personnel. There are, for example, technical training schools, the Extension Course Institute (ECI), the Airman Education and Commissioning Program

(AECP) the AFROTC Scholarship and Commissioning Program, Operation Bootstrap, the GI Bill, the United States Armed Forces Institute (USAFI) and the Air Force Institute of Technology (AFIT).

TECHNICAL TRAINING SCHOOLS.—Courses in technical training are conducted at five Air Force bases (all in the United States). The courses vary in length from 5 weeks to more than a year depending on the subject. They are taught through classroom instruction, demonstration, and actual work with equipment—learning by doing.

The students acquire skills that will be useful in their careers either in the Air Force or in civilian life. Also, as a result of the Community College of the Air Force, students receive credit for many of the courses when they enroll in a civilian school.

EXTENSION COURSE INSTITUTE.—The USAF Extension Course Program is available through Air University's **Extension Course Institute** (ECI) to officers and airmen in all parts of the world. ECI is the primary source of training for people who are unable to attend resident training courses. The courses are provided without cost to the student and cover a wide range of technical and professional Air Force subjects. More than 300 courses are offered, and enrollment averages about 300,000. Many of the students enrolled in these correspondence courses are officers interested in professional development and airmen (primarily noncommissioned officers) who study management and other professional military education subjects.

The largest group of ECI students consists of airmen enrolled in one of the more than 250 career development courses. These courses provide upgrade training in job specialties. They contribute to an airman's job skill and knowledge, necessary for advancement into positions of greater responsibility and higher pay grades.

AIRMAN EDUCATION AND COMMISSIONING PROGRAM.—The **Airman Education and Commissioning Program** (AECP) is open to carefully selected and qualified airmen who have had one or more years of active duty and wish to complete their college education. Qualifying students (men and women) are enrolled at a college to complete their bachelor's degree. Airmen who are accepted in the AECP are promoted to staff sergeant if they have not already achieved that rank and they receive full pay and allowances while attending college. The Air Force also pays for tuition, books, supplies and laboratory fees. When the airman students graduate, they then attend the three-month School of Military Science—Officers at Lackland AFB at the completion of which they are commissioned as second lieutenants in the Air Force.

AFROTC SCHOLARSHIP AND COMMISSIONING PROGRAM FOR AIRMEN.— In addition to AECP, a new airman commissioning program began in 1973 which involves granting AFROTC scholarships to eligible airmen and releasing them from active duty to complete their college education. The program is limited to airmen who meet eligibility requirements for pilot or navigator duty and who have at least one year of active duty. Depending on the amount of college credit required for their degrees, airmen may be awarded either two- or four-year scholarships. These scholarships include full tuition, fees, laboratory expenses, textbook reimbursement, and a subsistence allowance of $100 a month—the same scholarship granted to other qualified AFROTC cadets. Their status while in college is enlisted members of the Air Force Reserve, but upon graduation they are commissioned into the Air Force.

OPERATION BOOTSTRAP.—Airmen or officers on active duty who have not completed the requirements for a college degree can do so under **Operation Bootstrap.** Eligible personnel can take night classes at many colleges and universities either on base or at nearby campuses. They can take advantage of Air Force tuition assistance which pays 75 percent of tuition costs, or after six months of active duty, use the financial aid available under the GI Bill.

A special part of Operation Bootstrap is the allowance made for an airman who reenlists in career status and who can complete his degree requirements within from four months to one year. He may apply for "terminal" permissive temporary duty (TDY) to attend college on a full-time basis and earn his or her degree. The Air Force does not pay for his tuition, however he may use the educational benefits of the GI Bill. Under certain conditions, when the courses needed by an airman are not available to him at or near his base, he may apply for "nonterminal" permissive TDY to attend just these courses at an institution which does offer them.

THE GI BILL.—The benefits provided by the GI Bill operate in or out of the service. The bill is a Veteran's Administration program to assist the service man to complete his college or vocational training by providing an allowance of $220 per month plus an additional allowance if the student has dependents. The bill also may be used under Operation Bootstrap, described above, and pays $220 a month or the actual cost of tuition and fees, whichever is less.

THE UNITED STATES ARMED FORCES INSTITUTE.— There are more than 200 correspondence courses open to service men, wherever they may be stationed, through the **US Armed Forces Institute** (USAFI). The courses are conducted through civilian

schools which charge an initial registration fee of $10. All subsequent courses are given without charge as each course is successfully completed and all USAFI testing services are free. Each enrollee is assigned an instructor who grades and critiques the individual's assignments and keeps in close touch with him. The courses include high school level and the first two years of college.

AIR FORCE INSTITUTE OF TECHNOLOGY.—To insure the accomplishment of its mission, the Air Force must have a ready supply of officers and civilians who are professionally trained and equipped to plan and direct the acquisition and use of aerospace weapon systems. Meeting this demanding requirement is the primary business of the Air Force Institute of Technology (AFIT).

In its Resident School of Engineering at Wright-Patterson AFB near Dayton, Ohio (Fig. 29), and also at selected civilian schools and universities, AFIT offers courses at both the undergraduate and the graduate level. AFIT also has a medical education program. Those who attend AFIT do so on active duty while they are receiving full pay. Tuition is paid by the Air Force.

Figure 29. A student at AFIT's School of Systems and Logistics works on a management problem especially designed for the computer. Computer-assisted instruction is used regularly in several AFIT schools as a normal part of instruction.

In addition to the schools previously discussed, the Air Force, through the Air University at Maxwell AFB, Alabama, provides for the professional military education of the men and women who elect the make the Air Force a career. The schools at Air University include the Squadron Officer School (SOS), the Air Command and Staff College (ACSC), the Air War College (AWC), and the recently opened Senior Noncommissioned Officer Academy.

WORDS AND TERMS TO REMEMBER

community relations
Domestic Action program
hot line program
Big Brother Programs
Social Actions
Professional Officer Course (POC)
Flight Instruction Program (FIP)
Air Force Institute of Technology
Community College of the Air Force
Extension Course Institute
Airman Education and Commissioning Program
Operation Bootstrap
GI Bill
US Armed Forces Institute

REVIEW QUESTIONS

1. **What is the purpose of the Domestic Action program?**
2. **List examples of Domestic Action activities.**
3. **Describe some of the problems covered by the Social Actions Program.**
4. **How does Domestic Action differ from Social Actions?**
5. **Describe the AFROTC program. What are the differences between the two-year and the four-year programs?**
6. **What are the two basic purposes for the creation of the Community College of the Air Force?**
7. **Compare the Airman Education and Commissioning Program (AECP) to the AFROTC Scholarship and Commissioning Program. How do they differ?**

THINGS TO DO

1. Write or visit the Information Office of a nearby base and find out what Domestic Action programs have been organized there.
2. Contact the base Social Actions officer for information on his activities. You may want to invite him to talk to your class about his activities.

3. Find out what educational programs are offered by the Army or the Navy and compare them with those of the Air Force.

4. Many industries have started their own educational programs. Check with a local industrial firm and report back to the class on what educational programs they offer.

Chapter 4

How the Aerospace Industry Functions

THIS CHAPTER looks at the civilian side of aerospace—the industries that produce planes, space vehicles, and related equipment. First, the chapter discusses the relationship between the aerospace industry and its largest customers, the Government agencies. Next, it explains the way industry functions in fulfilling a Government contract. Finally, the chapter discusses aerospace research and its impact on our society. When you have studied this chapter, you should be able to: (1) list the Government departments and agencies which buy from the aerospace industry; (2) explain how an aerospace company operates when it is working on a large Government contract; (3) name some of the financial factors which influence the industry; and (4) describe at least five benefits of aerospace research.

THE CIVILIAN aerospace industry includes any organization or business directly involved in aviation or space investigation. This can range from the company which manufactures seats for the passenger section of a commercial airliner to the corporation which accepts a prime contract to manage an entire space program (Fig. 30).

The aerospace industry is unique among other industries in that its main customer is the Government. The automobile industry, by comparison, sells mostly to private citizens, as does the clothing industry or the television industry. The commercial airlines are among the customers of the aerospace industry, but 80 percent of aerospace business comes from Government contracts. The role of commercial airlines will be discussed more fully in the AE II text *Civil Aviation and Facilities*.

Figure 30. Airline passenger seats being assembled.

There are three areas to consider in studying how the aerospace industry functions in relation to the Government: (1) the governmental agencies doing business with the industry and the products they require; (2) the way the industry fulfills a Government contract; and (3) the role of research in the aerospace industry. In studying these areas we will keep in mind that the aerospace industry is flexible and that the rate of employment and productivity can change rather quickly.

GOVERNMENT PURCHASING

The two biggest Government consumers of aerospace products —particularly of the "space" items—are the Department of Defense (DOD) and the National Aeronautics and Space Administration (NASA). Both are Government agencies, and together they spend billions of dollars each year on aerospace research and products.

The Department of Defense

Aerospace contracts are entered into by the Department of Defense (DOD) and by its subagencies—the Departments of the Air Force, Army, and Navy. Both the DOD agencies and the Department buy a wide variety of equipment, ranging from supersonic jet fighters to missiles small enough for one infantryman to fire. The Department of the Air Force is the biggest aerospace customer in the Department of Defense.

Military Departments and Aerospace Industry

Research and development of aerospace systems in the Air Force is the responsibility of the Air Force Systems Command (AFSC). In fiscal year (FY) 1972, the Systems Command directed the spending of 28 percent of the total Air Force budget (the largest budget of any major command) on aeronautical, ballistic, space, and electronic activities. The Systems Command is interested in advancing overall space technology primarily so that this technology can be applied to the development of weapon systems for the Air Force. This knowledge can be applied in other areas, however. Many of the NASA space boosters were first used as missile boosters in Air Force missile systems (Fig. 31). At present the command is interested in the development of the F–15, and the B–1, and the A–X close support aircraft.

Some of the space-related activities in which the Systems Command is involved include the development of reentry techniques to be used by future astronauts; research in bioastronautics; and experimentation with new propulsion systems.

The Army is one of the largest users of helicopters and is continually involved with developing new kinds of helicopters of greater capabilities. The Army is also responsible for the development and testing of the Safeguard system. Safeguard is the only antimissile missile system in advanced development by the United States. Many firms are engaged in the Safeguard program development.

The Navy also buys missiles, aircraft, and sophisticated weapons from the aerospace industry. The Polaris-Poseidon system of nuclear-powered ballistic missile submarines is the center of the Navy's nuclear weapons capability (Fig. 32). Naval aircraft and aircraft carriers are vital to the Navy's conventional forces. Plans for expanding the role of the helicopter and making greater use of V/STOL aircraft in the Navy are now being made. The Navy also supports research in advanced radar and sonar and other electronic equipment.

This is only a partial list of the aerospace-related programs in which the military Services are engaged. However, it shows how closely the aerospace industry's growth is tied to programs related to national defense.

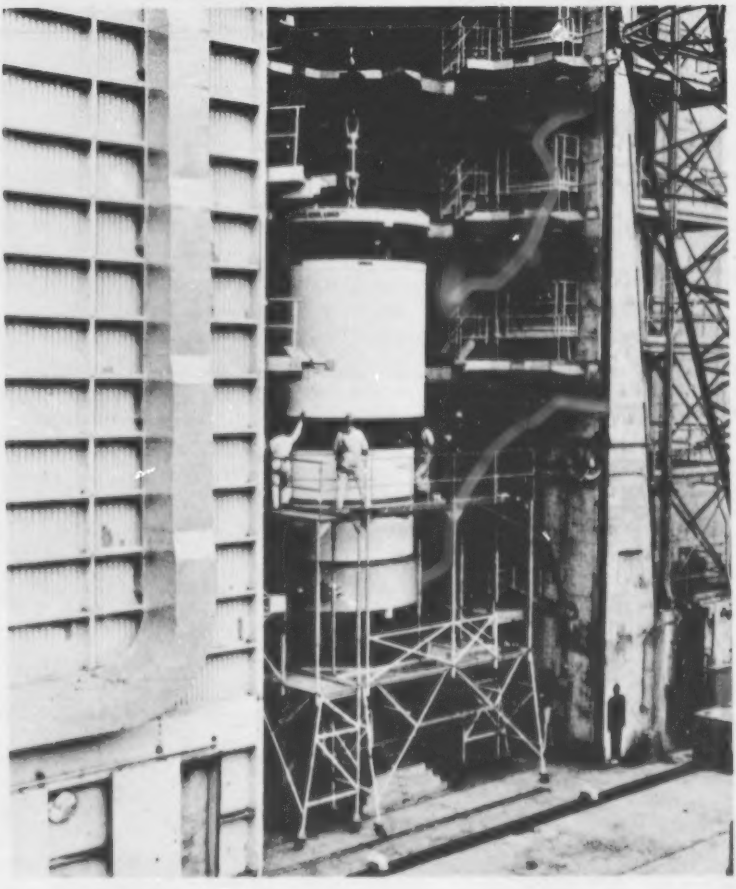

Figure 31. A 1.2 million-pound thrust solid rocket being assembled. Rockets of this size are used in pairs as the booster stage of the Air Force Titan III- and -D.

The National Aeronautics and Space Administration (NASA)

The National Aeronautics and Space Administration (NASA) is the Government agency responsible for all matters related to civilian space and aeronautical research activities. All of the US manned space flights have been administered by NASA, although almost all of the astronauts have been military men.

Besides the manned space program, NASA unmanned spacecraft have explored some planets close to Earth, such as Mars. The Pioneer 10 and 11 missions are pushing our knowledge of space to include the planet Jupiter.

At present NASA projects include the Space Shuttle (Fig. 33) and Skylab. The Space Shuttle will extend US capabilities for both manned and unmanned flight, making space operations less costly. By making repeated trips and by using satellite equipment over and over again, millions of dollars can be saved. The civilian aerospace industry is playing the important role of designing and manufacturing this and other spacecraft.

The first Skylab mission began in May 1973. Skylab, the first US experimental space station, should provide more information about the earth, and sun. Many experiments can be conducted in the zero gravity conditions of space which cannot be conducted on earth. Unlike previous manned flights, a means is provided for rescuing the astronauts from Skylab should this become necessary.

Other Major Government Customers

While the Department of Defense and NASA are the major governmental customers of the aerospace industry, there are other Government agencies which are customers on a smaller scale. Some of the most important minor governmental customers are

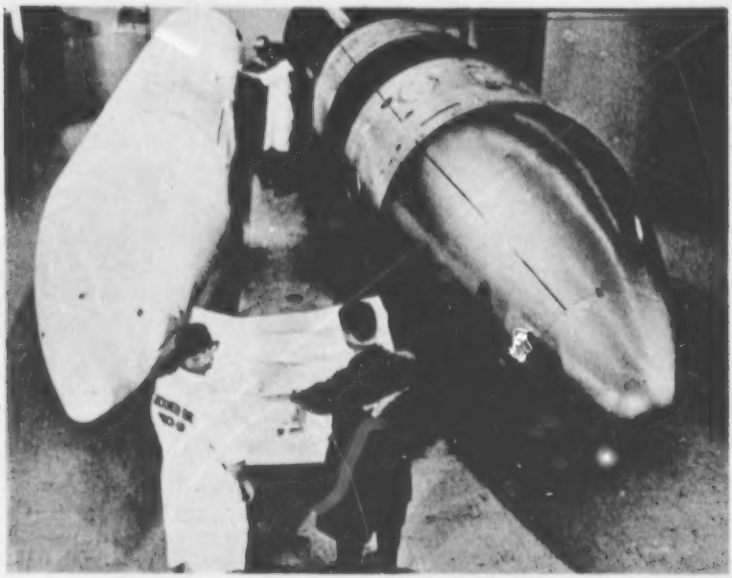

Figure 32. Poseidon fleet ballistic missile.

Figure 33. Mircoscopic beads being studied for possible use as tank insulation for super-cold oxygen and hydrogen that will fuel the Space Shuttle

the Atomic Energy Commission (AEC), the Federal Aviation Administration (FAA), and the National Weather Service of the National Oceanic and Atmospheric Administration (NOAA).

These agencies can only be called "minor" customers when their orders are compared with those of NASA and the Department of Defense, however. In reality they spend a considerable amount of money on aerospace and, in comparison with any civilian customer, they would be described as "major."

The AEC is very active in the development of nuclear rockets and isotopic thrusters and in reactors capable of powering them. Along with these projects comes research into the development of fuels and materials, hardware, and facilities.

The FAA is concerned with long-range radar, with problems of the sonic boom (the shock waves generated by aircraft passing through the sound barrier), and with computerized air traffic control. The FAA also is seeking information on air turbulence and how to reduce its effects on jet aircraft and is engaged in

the development of V/STOL aircraft for commuter transportation, and an automatic landing system. This system would mean greater landing safety and increased reliability of scheduling by permitting aircraft to land in any weather conditions.

The National Weather Service has several weather satellites (sometimes called "weathersats") in orbit, such as Tiros and Nimbus (Fig. 34). Since the first Tiros and Nimbus satellites were launched, many improvements have been made. Nimbus 5, for example, provides information for a wide range of earth sciences, beyond meteorology and data for weather forecasting. A new joint NASA-NOAA project is the geostationary operational environmental satellite (GOES). The satellite, which will appear as if stationary above the equator, will provide continuous data about weather and other environmental factors in the atmosphere over the United States.

These Government agencies, then, are the chief customers of the aerospace industry at the present time. The industry is so closely associated with the Department of Defense and with the National Aeronautics and Space Administration that it has been called the "national survival industry."

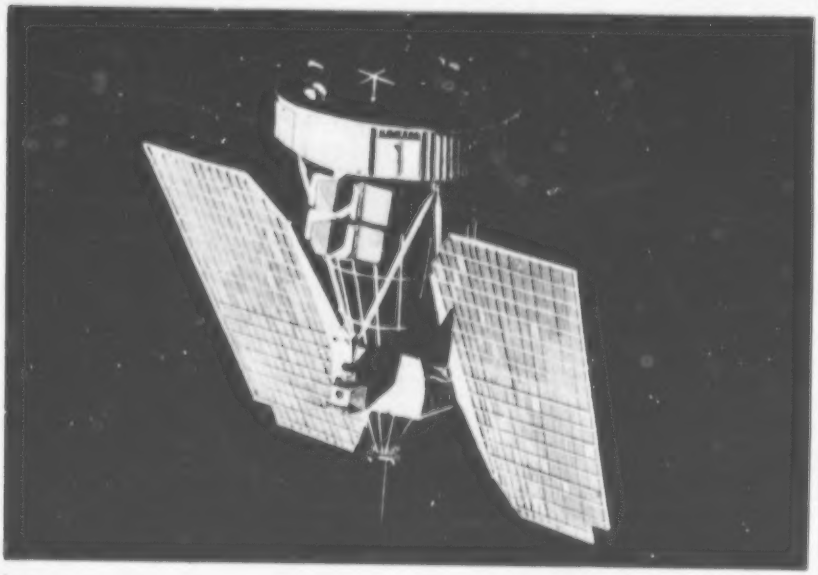

Figure 34. Nimbus weathersat in orbit.

GOVERNMENT CONTRACTING

Government contracts for space-exploring projects are huge. They call for know-how and materials of widely varying types. The complexity of the total space venture is such that no one company could hope to fill every need. For these reasons, the industry resorts more extensively than any other industry to subcontracting. But the overall contract for the space contract usually goes to one company. That company's contract is directly with the Government agency sponsoring the space project. The **prime contractor's** job is management of the full project, assembly of the many parts, testing for reliability, and final delivery of the operational product.

The other companies which share in the building of the total project are known as **subcontractors.** They take over large portions of research and development. If a prime contractor is responsible for a whole space vehicle, a prime subcontractor might be responsible for the launch vehicle or for the propulsion or navigation control system. A smaller subcontractor might produce only the food, packaging, and waste system for the flights or the astronauts space suits.

More than 3,000 subcontractors provided parts and services for the Gemini capsule alone. Their contracts added up to over $348 million and the smallest of these contracts amounted to $134.34.

Because of the size of the overall contracts, many smaller aerospace companies have chosen to specialize in the production of a few items rather than to try to outdo the larger companies. These small companies are thus able to compete more effectively for subcontracts.

There are several financial factors which aerospace companies must take into account in order to make a profit. We will look at four of these special factors in order to understand the aerospace industry, its problems, and how it functions.

The first of these factors is **diversification.** Because of the uncertainty of Government contracts, some of the larger companies have branched out into other fields so that a greater share of their business will be with private citizens. If a space contract is cancelled, they can then concentrate their production on other things such as ships or bicycles (Fig. 35).

The opposite choice, which is often made by smaller companies, is **specialization.** Specialization requires careful study, so that a company does not become completely tied to products which may become obsolete. Smaller companies cannot compete with the wide range of products produced by the larger companies, however, so they tend to concentrate on doing just a few things well. This can range from the development of gas

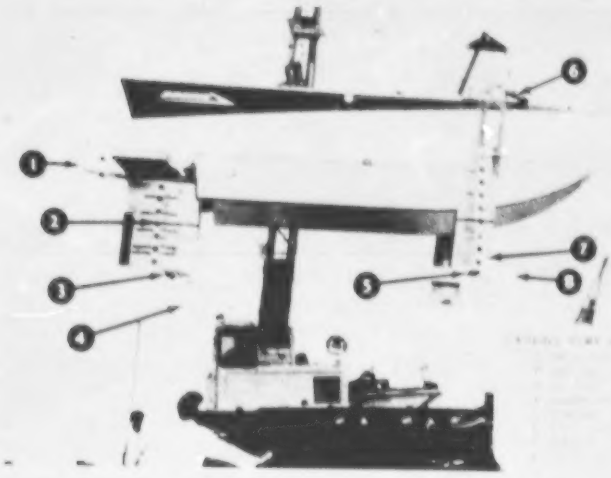

Figure 33. "Little Squirt" produced by Boeing Company is an example of aerospace diversification in nonaerospace products.

turbines or fuel cells to the production of a special kind of nuts and bolts.

A third financial consideration is **mass production.** In other industries, such as the automobile industry, the design for a product can be used thousands of time. Interchangeable parts can be manufactured in great quantities cutting down on the cost of any one individual part. In the aerospace industry, however, because of the rapid changes in technology, planes and missiles cannot be manufactured in such great amounts, as they quickly become outdated. The whole cost of research and development must be absorbed by a relatively small quantity of hardware, which makes the unit cost of these products quite high.

A fourth factor which is important to the financing of an aerospace project is "lead time." **Lead time** is the interval between the time an order is placed and the time the finished product is delivered. During that time, planning, research and development, and the actual making of the finished product occur. Delivery of a complex aircraft such as the F–111 did not occur until five years after the prime contractor was selected for the job. This meant that in 1962 the Air Force and the Navy had to predict aircraft requirements for the late 1960s and the 1970s, which is when the plane would actually be used.

With such lead times it is not unusual for a weapon system (fighter or bomber aircraft or missiles) to show signs of obsolescence by the time it goes into action. In fact, obsolescence is

another factor that aerospace men are having to learn to live with: technology advances so rapidly that it is unusual for a weapon system *not* to be at least slightly out of date by the time it first goes into service.

As you can imagine, the longer the lead time for the production of an aircraft or any other aerospace product, the more out of date that equipment will be when it is put into service. Attempts to keep up with technology by including the latest developments are not successful because plans for the finished product have to be continually revised. The time required for this revision extends the lead time and technology advances even as the plans are changing.

All of the above factors—lead time, mass production limitations, and problems of diversification and specialization—affect the price of aerospace products and must be considered by the management of aerospace companies.

The fact that the aerospace industry is so dependent on Government contracts for its livelihood means that the industry is affected by political changes. The change in emphasis that has brought about a cutback in the purchase of space vehicles, for instance, is affecting the lives of thousands of people who depended on the industry for employment. A decision to move ahead on a new bomber for the Air Force or an expansion in the space program would also have significant effects.

When there is a great demand for a service, the supply rises, and when the demand decreases, the result is an overproduction. Today, we find aerospace engineers out of work in many places because the concerns of the voters have changed, and Government money is going into other fields such as health care and pollution control.

Besides the cutback in the space program, we also find a desire on the part of voters to spend less for military or defense programs. There is a natural drop-off in defense production with the ending of the war in Vietnam; and there is more reluctance to spend money for airplanes or missiles. Admittedly, other businesses feel these political pressures but probably none as intensely as the aerospace industry.

AEROSPACE RESEARCH

The heart of the aerospace industry is research, the quest for knowledge. Without research, there would be no jet transport, no V/STOL (vertical/short takeoff and landing) aircraft, no manmade satellites, no Venus space probes. There would be no amazing developments in electronics and medicine, in computers and plastics, or in any other field.

The partner of research is **technology,** the applied science used to make improvements in the industrial arts and in their products. Where research is the quest for knowledge, technology must be considered as the mechanical means of putting that knowledge to good use. Research provides a basic concept, technology develops that concept into a physical product.

The phrase "research and development," or "R&D" as it is called, is used quite often in the aerospace industry. Implied in the "development" part of the phrase is the use of technology. In aerospace, research and development go hand in hand. This section will attempt to give an idea of the results accomplished in aerospace by the team of R&D.

Basic and Applied Research

Research may be classified as either basic or applied research. **Basic research** is the quest for knowledge for its own sake, without thought of how the knowledge may be used, or even if it can be used. A basic research scientist may, for example, wonder if there is a way to amplify light. He may pursue this question until he finds that there is a way to do it through the stimulated emission of radiation. Through use of electrical energy and a certain gas, he can produce bursts of light millions of times brighter than sunlight. This knowledge satisfies the basic research scientist and perhaps finds its way into a scholarly paper he may write for a scientific organization.

Applied research, on the other hand, is the quest for knowledge which can be used for a particular purpose, to solve a particular problem. It is also a quest for ways to use knowledge produced through basic research.

The Impact of Research

The results of aerospace research can be seen every day, even by people who have no connection with space technology. Scenes from all parts of the world can be seen on television by means of communications satellites (Fig. 36). For example, the Olympics have been broadcast to all parts of the world by satellite. Transistor radios and solid-state circuits in television sets are also products of aerospace research.

These examples are in the communications field, which probably has shown the most rapid transfer of innovations to commercial use, but aerospace developments in other fields are equally spectacular if not as immediately useable.

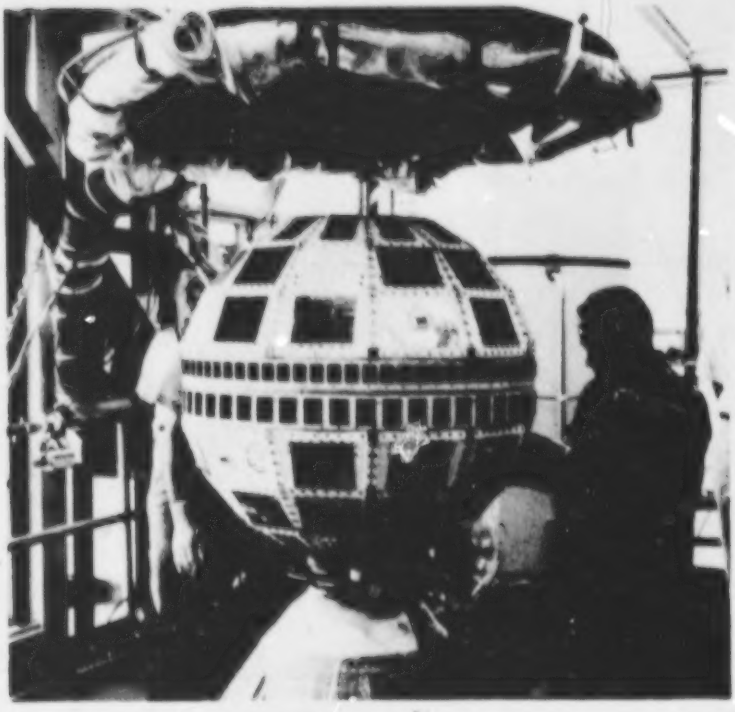

Figure 36. Telstar communications satellite.

In electronics research, for example, **microcircuits** have been developed which greatly reduced the area needed for wiring. Advances in infrared gas analysis may soon show the way to controlling air pollution. Electromechanical artificial hands have been developed which allow their user to grip things, and to control the pressure the hand exerts.

Computers are used by schools, by newspapers, and by many other areas of society too numerous to list. They are used in hundreds of ways by every form of Government agency and by the military services. In business and banking they have become essential (Fig. 37).

Advances in medicine have been spectacular. Newly developed medical products and techniques include the implanting of miniature radio transmitters in the body to monitor the bodily processes; the use of laser knives to destroy cancer cells; the use of radioactive injections and infrared photography to find trouble spots in the body; pressure suits to stop internal bleeding; a plastic spray material to stop bleeding from wounds; and cryosurgery.

Cryosurgery is the use of cryogenics in surgery. **Cryogenics** is the scientific name for the field dealing with supercold temperatures, that is, temperatures ranging from −50 degrees C to near absolute zero (−459.69 degrees F). **Cryosurgery** uses this supercold to destroy ailing tissues in nearly any part of the body, with little pain and with little loss of blood.

Cryogenics itself resulted from aerospace research. Very cold temperatures are required for the storage of liquid oxygen, fluorine, and hydrogen, which are used as rocket fuels. Cryogenics developed from this need for extreme cold. To date, scientists have produced temperatures within 1/4 of 1 degree of absolute zero. Absolute zero is the temperature of complete heat absence at which molecular motion stops.

Strange things happen in the world of supercold. Electricity can move through a wire without resistance; liquified helium flows uphill; some materials get more brittle, others get tougher; fiber glass-reinforced plastics are stronger than at normal temperatures; and aluminum alloys are stronger than steel.

Cryogenics is a very important area of research and holds promise for improvements in a number of fields: medicine, propulsion, electrical power, to name a few.

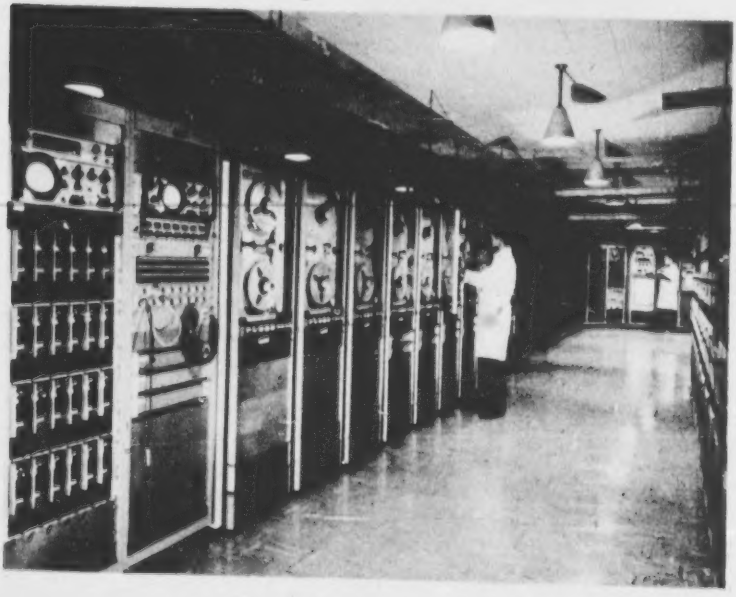

Figure 37. Data acquisition center at United Technology Center.

New materials have been developed through aerospace-related research. One of the most impressive research feats is the production of a material which is lightweight, twice as strong as a good aluminum alloy, and 11 times as strong as steel. It could be used to build superskyscrapers, giant domed buildings, or stadium domes.

This material may be the future substance for home construction. House sections could be prefabricated and when the sections were put together they would be strong enough to withstand any natural force. With a soft plastic matter for a binding material, the white wall could possibly be electrically charged. Electrical plugs could be stuck into the walls any place in the house; and the current would flow without the need for complicated wiring.

The nature of the space environment, the need for strong, light materials, and the cost of space research have led to the development of better products in other fields. Photography has benefited, as demonstrated by the fact that US Surveyor spacecraft have relayed color pictures from the surface of the moon without the use of color film. This was accomplished through the use of color filters in the reconstitution on earth of black-and-white pictures from Surveyor. The color photos taken during the manned Apollo flights are excellent.

Observation satellites may be used in the future in agriculture, forestry, geology, oceanography, navigation, and even traffic control.

The future satellites may be instrumented to show construction of buildings—and even what materials are being used in the construction. They also may be used to determine the water content of soil, the heights of trees, salinity and contamination of water, and other information. They may even carry sensitive equipment which can track schools of fish in the ocean.

A shortage of fresh water is already something of a problem in the world and is expected to grow into more of a problem in the next few years. Space research has devised ways to reuse water salvaged from the human wastes of astronauts; some of the salvaging techniques can be applied to sea water and to other chemical mixtures.

A relatively new field is **human engineering**: the study of the reaction of human beings to their surroundings and to the arrangement of those surroundings. Certain aspects of this new field such as the effects of noise-free environments may lead to innovations that can improve the performance and the general attitude of people in the world's urban areas. The kind, degree, and source of noise is considered important by psychologists involved in human engineering. Human engineering is discussed further in the AE-III text, *Human Requirements of Flight*.

The aircraft industry has also benefited tremendously from space research. Engines, automatic pilots, radar systems, and flight equipment have been greatly improved.

Techniques developed for the production of food in space—on manned satellites, for instance—could prove invaluable on earth itself, as the world's population grows and its food demands increase. Also valuable to food production is the use of satellites to furnish accurate weather observation. Space research is resulting in the development of new tools and techniques that can be used in agriculture. One example is infrared food blanching to prepare foods for canning or freezing.

Infrared radiation is being used in a number of different ways in a number of fields such as missile electronics. Since it cannot be jammed, infrared radiation appears to offer a challenge to radar for use in guidance devices, tracking systems, and reconnaissance vehicles. Infrared photography is used in weather satellite coverage and in aerial reconnaissance. Industrially, infrared radiation is used to measure chemical compositions in petroleum refining and distilling and in analyzing metals.

Thermoelectric devices for heating and cooling, originally designed to provide energy sources for space vehicles, have been adapted to commercial application. The glass industry has made advances in optics as a result of research conducted on lenses and plastics. A material developed for use in coating missile and aircraft radomes (pyroceram) is now being used to make "no-stick" cooking pots and pans.

The **plasma arc torch** has been developed for use in the mass production of ultrahard materials. The torch, an outgrowth of plasma technology, develops heats in excess of 30,000 degrees Fahrenheit and can work within tolerances of two-thousandths of an inch. The principle of beam guidance, used for guiding missiles to their targets, has been applied to surveying and has had a significant effect on the surveying industry.

Techniques learned in controlling rocket blast are being put to use in the mining industry; and jet drilling is used in quarrying. These methods have uncovered new sources of ore and have eliminated much of the wastes of the old mining and quarrying systems.

Fields other than the ones mentioned here also are feeling the impact of space-related research. In fact, this research touches everyone. The spinoff benefits of space research may not always be as obvious as the transistor radio, but they are around us in places we may never have suspected.

The civilian aerospace industry is a vital part of the aerospace community, for without the civilian producers and manufacturers the Government and the military could not accomplish their plans.

The many career opportunities in the aerospace industry are described in the following chapter.

WORDS AND TERMS TO REMEMBER

prime contractor
subcontractor
diversification
specialization
mass production
lead time
technology
basic research
applied research
microcircuits
cryogenics
cryosurgery
plasma arc torch

REVIEW QUESTIONS

1. **Which Government agencies are the biggest customers of the aerospace industry?**
2. **What are the space-related functions of the Air Force Systems Command?**
3. **How are the Army and Navy involved with the aerospace industry?**
4. **Explain subcontracting by aerospace companies.**
5. **Explain diversification and specialization giving the reason for each.**
6. **What effect does mass production have on aerospace industry?**
7. **What is meant by lead time?**
8. **How do basic and applied research differ?**
9. **Name and describe five nonspace benefits of space research.**

THINGS TO DO

1. Write to the public relations office of an aerospace company to find out if its operations are diversified and, if so, what other products it makes.
2. Select five aerospace companies listed on the New York Stock Exchange and follow the price of their stocks for a given period of time. Note the effect, if any, of national or international events on the stock prices.
3. Select an aerospace system under development such as the B-1 or Skylab. Identify the prime contractor and several subcontractors.

SUGGESTIONS FOR FURTHER READING

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Chapter 5

Career Opportunities in Aerospace

THIS CHAPTER examines job opportunities in civilian and military aerospace. First, it describes some of the aerospace jobs in commercial aviation, Government agencies, industry, and research. Then, it reviews the career fields for officer and enlisted personnel in the Air Force, describing a number of jobs in each group and explaining the promotion systems. When you have studied this chapter, you should be able to: (1) describe at least six job opportunities in civilian aerospace, selecting examples from different areas discussed in the chapter; (2) describe the jobs of rated Air Force officers; (3) list five nonrated officer jobs and tell some of the duties of each; (4) describe six enlisted jobs, using examples of jobs directly related to flying and those not directly related; and (5) explain the officer and enlisted promotion systems.

THE AIR FORCE is not only a career in itself; it opens the way, through the many opportunities for education and vocational training, to a large variety of satisfying careers in civilian life.

Career opportunities in the aerospace industry are as varied as the industry itself. In Chapter 4, we emphasized those portions of the industry which are concerned with Government contracts—the suppliers for the Department of Defense, NASA, and other Government agencies. In this chapter, we will look at career opportunities with commercial airlines, in the manufacturing end of the aerospace industry, and in the Air Force.

JOBS IN THE AIRLINE

Commercial airlines and general aviation are described in the AE-II text *Civil Aviation and Facilities*. Commercial flying includes such diverse services as cropdusting, mapping (aerial views of cities or countryside), and highway traffic regulating (directions relayed from helicopters advising motorists which road to take), in addition to transporting passengers and cargo. However, since transportation is the main business of the commercial aviation industry, the following section will be primarily concerned with jobs connected with air transportation.

The flight engineer, the copilot, and the captain are the three people who make up the flight deck crew. The person responsible for monitoring the operation of the aircraft while in flight and inspecting it before takeoff, is the **flight engineer.** The Federal Aviation Administration (FAA) requires that a flight engineer, or second officer, be aboard most three- and four-engine aircraft and that a flight engineer be licensed by the FAA. The necessary background for becoming a flight engineer can be obtained in several ways. Experience as an aircraft mechanic or as a pilot are two ways. To be licensed by the FAA, the applicant must pass a written test covering many phases of aviation such as flight theory, fuel requirements, weather as it relates to aircraft performance, and maintenance procedures. Flight engineers who are pilot-qualified can progress to becoming copilots, and most commercial pilots have served in flight engineer status. Flight engineering is a field in itself, however, and not all flight engineers become pilots.

The **copilot,** or first officer, assists the pilot in his job of flying the aircraft. Since in many airlines copilots are first required to serve as flight engineers, the job qualifications are the same. Generally, a prospective pilot must have a minimum of two years of college; however, a bachelor's degree is preferred. He must have an FAA commercial license and instrument rating and a minimum of 500 hours single or multiengine time in a jet or heavy transport plane. There are additional requirements pertaining to age and weight, although these may vary from one company to another. Character references, satisfactory interviews, and the satisfactory completion of company physical and psychological examinations also are required.

After having served as a copilot, the next step in career progression is to **captain** (Fig. 38). The captain is the man who is ultimately responsible for the safety of the passengers and cargo aboard.

On the ground, one of the most important people who contributes to getting the airplane into the air is the **aviation mechanic.** Aviation mechanics are maintenance men who hold ratings from

Figure 38. Airline captain filing flight plan.

the FAA, authorizing them to work on the airframe (A), the powerplant (P), or both (A&P). To hold these ratings they must pass written tests administered by the FAA. The mechanics are qualified to service, repair, and overhaul aircraft bodies and engines to insure their airworthiness. They also replace and reassemble parts of aircraft such as wings, fuselage, tail assembly, landing gear, and fuel tanks. Some of the necessary qualities of a prospective **A&P mechanic** are mechanical ability, an interest in aviation, a desire to work with tools and with his hands, the temperament to do dependable and responsible work, and the desire to continue studying to learn the changes in newer aircraft (Fig. 39). There are two ways to become an aircraft mechanic. One way is to complete 18 months experience in airframes for an (A) license or 18 months experience with engines or powerplants for a (P) license; 30 months combined experience is required for an (A&P) license. The other way is to graduate from an FAA-approved mechanic school.

Advancement possibilities in this field include promotion to lead mechanic (crew chief), inspector, lead inspector, and supervisory or executive positions. In many cases the mechanic must pass further company tests to be promoted.

One of the most visible crew members on an airplane trip is the **stewardess** (Fig. 40) or **steward** who is a member of the cabin crew. Originally, airlines employed only women as flight attendants. However, this is no longer the case. To apply for this position you must be a high school graduate, single, in excellent health, and willing to travel. As in the case of pilots, there are restrictions as to age, height, and other physical characteristics.

Other jobs related to airlines include traffic representative and airline dispatcher. The **traffic representative,** with whom the passenger deals in making his reservations, is the person who handles

Figure 39. A and P mechanic students are taught subjects ranging from minor repairs (above) to complex engine overhaul (below).

passenger ticketing and information (Fig. 41). For a typical airline, two years of college plus knowledge of a foreign language is required.

The job of **airline dispatcher** is another one that requires an FAA certificate. Dispatchers are in charge of scheduling flights and are concerned with details such as the amount of fuel required for a flight, flying time, flight altitude, weather conditions, and sometimes with the weight and balance of cargo in the aircraft (Fig. 42). After a plane is airborne, the dispatcher continues to keep the pilot informed of changing weather conditions or other

Figure 40. Airline stewardess serving a passenger.

Figure 41. Airline traffic representatives assisting customers with their plane tickets.

Figure 42. The airline dispatcher discussing flight plans with the pilot.

problems which may arise. To be licensed, the dispatcher must pass a written test on subjects such as radio procedures, weather analysis, Federal aviation regulations, and airway traffic procedures. He must also pass an oral test demonstrating his ability to interpret weather information and must show familiarity with landing and cruising speeds, airline routes, and other areas of information pertinent to his job. As in other jobs certified by the FAA, the necessary background for passing the test may be obtained by attending an FAA-approved dispatcher school, or by gaining on the job training by working for another dispatcher as a dispatch clerk or as an assistant dispatcher.

The field of employment is so broad in commercial airlines that it includes such diverse jobs as architectural and mechanical draftsmen. The airlines also employ specialists such as accountants, key punch operators, secretaries, receptionists, and telephone operators.

This list of career opportunities with the commercial airlines is only a sampling. Further information can be received by talking to a school career counselor or by writing directly to the airlines and requesting more detailed information.

JOBS IN THE MANUFACTURING OF AIRCRAFT AND SPACE VEHICLES

The aerospace industry is large and diversified, and its main customer is the Government. There is no market outside of the Department of Defense for the production of intercontinental ballistic missiles (ICBM) or fighter-bombers, for instance, unless they are being sold to the governments of other countries. Likewise, a project such as Skylab is financed by the Government because no one corporation can handle it. When we speak of the manufacturing side of the industry, we are including the production of aircraft for commercial use also.

Those persons most directly involved in the manufacturing of aerospace vehicles tend to fall into the two categories: engineers and technicians (Fig. 43). Engineers are responsible for designing new products, and technicians translate the designs into production.

Aerospace Engineers

To understand the role of **aerospace engineers** in the manufacture of space vehicles, let us see how an imaginary company would operate to produce a new space vehicle. The president of an aerospace company, who wanted to obtain a prime contract to build a new spacecraft for NASA, would first have to consult

with the vice president in charge of production who would present the specifications to the engineers working for him.

Perhaps the first specification for the new spacecraft is that the internal controls and communications equipment must use batteries. The internal power supply is an area of specialization for the **power supply engineers.** They will try to develop specific plans for constructing a battery-powered internal supply system for this spacecraft. They may decide that this specification is unworkable and that solar cells or nuclear energy would provide a more appropriate system.

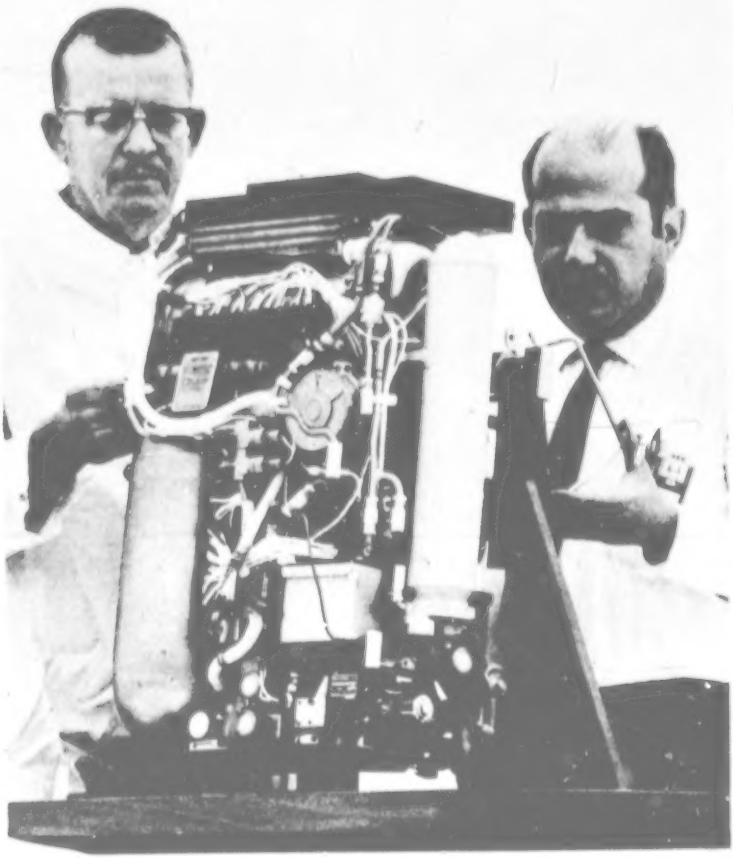

Figure 43. An advanced life-suport backpack, designed to keep astronauts alive and well on moon missions, is examined by an assembler-technician and a project engineer.

The next specification might be that the communication and tracking network for this spacecraft must be able to send signals millions of miles farther than ever attempted before. The vice president in charge of production would present this problem to his **communication and tracking engineers.** They are the specialists responsible for perfecting techniques for sending, receiving, storing, amplifying, and retransmitting communications signals.

Suppose the next requirement is that the spacecraft be constructed of materials strong enough to withstand given extremes of heat and cold. The **materials engineers** would deal with problems such as this. Materials engineering is a part of the chemical engineering field.

The next problem is one of guidance and control. **Guidance and control engineers** must determine the magnetic and electrical fields along the space trajectory and the variations in gravity and radiation the spacecraft will encounter. If the spacecraft is going to land on another planet, the guidance and control engineers are responsible for providing instrumentation for insuring the aircraft touches down in the proper location.

There are three other major problems the solutions of which are beyond the capabilities of the company's engineers. These are problems in instrumentation, propulsion, and construction. The vice president advises that it would be best to talk to subcontractors about handling these other requirements. Besides not having enough engineers in these specializations, the company does not have the technicians either.

After looking over the records of past contracts, the president determines that a smaller company, Company A, which specializes in instrumentation, can probably deal with the new instrumentation requirements. They involve the miniaturization of the instruments and the creation of a larger storage bank for the great quantities of information which will be coming in during the flight. A faster relay of this information to earth is also required. **Instrumentation engineers** work at developing instruments for gathering, analyzing, and transmitting information about space phenomena to scientists on earth as well as to astronauts in the spacecraft.

Another company, Company B, works primarily in the propulsion field. Their **propulsion engineers** are qualified to make the decisions on the type propulsion that should be used on the flight.

The last problem is the construction of the spacecraft, its testing, the building of storage and launch facilities, and the construction of other associated installations. Architectural, civil, and construction engineers will be involved in this phase. They will plan the best configuration of the spacecraft. Company C will handle this side of the production, using many smaller subcontractors for the construction of the related facilities. A complication is that the

construction of housing and research facilities will have to be done on the other planet after the astronauts arrive. For this part of the project, the **construction engineers** must allow for reduced gravity, temperature extremes, and other differing environmental factors.

To coordinate the specialties just mentioned, a **systems engineer** is needed to examine the whole system and to formulate a coordinated workable master plan. This is especially important since the contract is large and requires much subcontracting. The systems engineer must consider the manufacture, design, development, management, and use of the vehicle system, and he must assure compatability of all the components. He must be a generalist who can converse with all of the other engineers, and he must also have some basic management skills.

Aerospace Technicians

An important and relatively new occupational classification is that of the **engineering technician.** Engineering technicians are to the engineers what nurses are to doctors; and their status has risen in the same manner as that of nurses. Technicians are given concentrated and specialized training. Many high school graduates choose careers as technicians, rather than going through a course leading to a college degree. For every 100 engineers and scientists working in the aerospace industry in this country, there are about 53 technicians.

The technician is qualified to use gauges and scientific testing equipment (Fig. 44). His job is to guide craftsmen in building prototype units, to collect data, perform lab tests, make computations, prepare scale drawings, write reports, build models, and keep scientific equipment operating.

Many schools specialize in training technicians. These schools differ from trade or vocational schools in that they do not teach manual skills. Rather, they furnish the student with special knowledge in a broad, general field—such as electronics, or aircraft design—and give him a solid foundation on which he can build a life-long educational program. Courses in technical schools tend to be less abstract than they are in colleges. For instance, certain basic liberal arts courses are required for the technical degree as well as for the college degree; but the English courses in the technical institute will be oriented to application in the technical field. This explains why a technical school graduate can sometimes write a better technical report than a college graduate can write in the same field. Similarly, mathematics and physics courses are taught in both colleges and technical institutes; but in the latter, they are slanted more toward the student's particular

field and are less abstract. Technical school students complete training faster than it would require to complete college—up to three years faster. This means that the technician is making money at his job while the engineering student is still in school. However, the engineer is more likely to advance to supervisory and executive positions.

JOBS IN RESEARCH AND SCIENCE

The career opportunities in aerospace activities, either civilian or military, are not limited to those described in the previous section. Astronomy, chemistry, biology, medicine, and a number of other branches of science play an important part in aerospace research.

Careers in University and Research Centers

The beginnings of rocket and space technologies can be traced to the efforts of individuals working in universities and colleges. The great pioneers in astronautics were teachers, college professors, or people who maintained a close relationship with the academic community. An excellent example is Robert Goddard, America's "Father of Rocketry." Many of Goddard's most important research efforts were performed at Worcester Polytechnic

Figure 44. Instrument technician using a light monitor to determine the amount of solid-particle pollutants on the filter paper.

Institute, Clark University, and Princeton University. Some of the most outstanding achievements of direct importance in space work have come from the universities and research institutes.

Research is supported by military and civilian agencies of the Government, by private industry, and by grants from foundations. One of the most famous research centers in the United States is the Jet Propulsion Laboratory (JPL). JPL is at the California Institute of Technology (Cal Tech). The institute was established toward the end of World War II to conduct research in guided missile problems and applications. It used the facilities at Caltech and at a nearby air base, and it also received assistance from contractors. In 1958, it was transferred from the Army to NASA, and work on military programs gave way to work on space missions (Fig. 45). Institutions similar to JPL include Lincoln Laboratory at Massachusetts Institute of Technology, Applied Physics Laboratory at Johns Hopkins University, Stanford Research Institute, Cornell Aeronautical Laboratory, and several others.

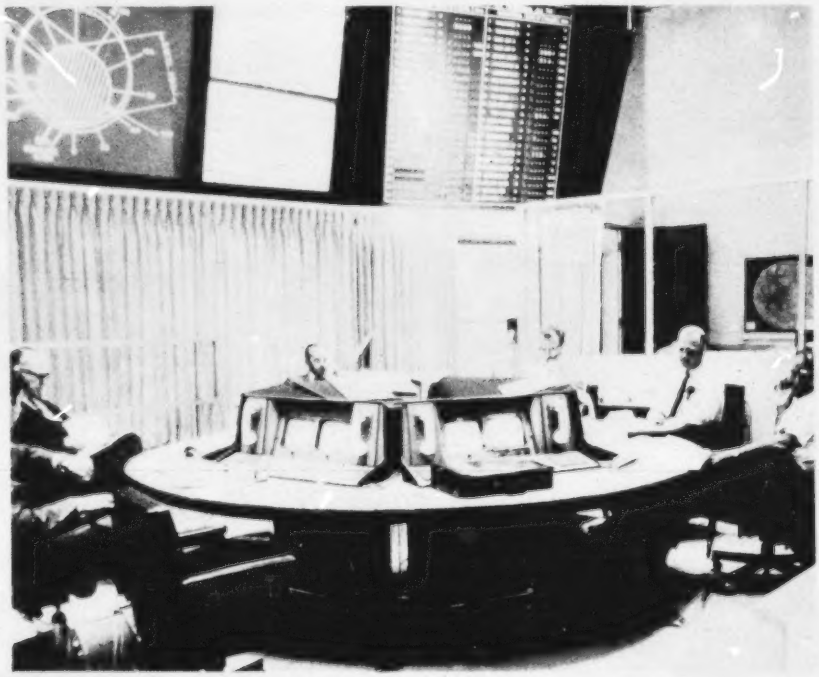

Figure 45. Personnel of the Jet Propulsion Laboratory await progress report from space shot.

Astronautical Science

The word **astronautics** is defined in the Air Force Second Aerospace Glossary as "1. The art, skill, or activity of operating space vehicles. 2. In a broader sense, the art or science of designing, building, and operating space vehicles." This definition, however, does not indicate how many separate sciences are involved in, or influenced by, astronautics. The following are some of these sciences.

ASTRONOMY.—With space exploration a reality, there is a need to know as much as possible about the sun, the moon, the planets, and other celestial bodies. The **astronomer** studies the relationship between planets, their atmospheres, and their composition. New instruments such as satellite-borne telescopes are making more information available to the astronomer. Astronomy, like most sciences, requires a strong mathematical background.

CHEMISTRY.—Chemistry is a broad discipline including many branches which are important to the aerospace community—organic, inorganic, biochemistry, and **astrochemistry.** One of the major jobs of the **space chemist** is to develop propellants for spacecraft (Fig. 46). To a great extent, space exploration is dependent on the availability of adequate propulsion systems.

BIOLOGY.—Space biology, or **astrobiology** is concerned with the effects of space travel on living organisms. Biologists have already experimented with plants, insects, bacteria, and other life forms which have been sent into space (Fig. 47). This science will be very important for future interplanetary space travel. Before the trips are made, scientists will need to know what biological reactions to expect. Space biology presents many interesting challenges, with most of its developments yet to come.

MEDICINE.—**Space medicine** differs from space biology in that it is primarily concerned with the effects of space travel on human life. The two fields are, however, closely related. Space medicine tries to prevent or alleviate the medical problems caused by space flight and, in so doing, includes the work of other scientists such as physicists, radiobiologists, biochemists, and human engineers. Some of the discoveries of space medicine were mentioned in Chapter 4. These medical spinoffs from space research will probably continue to occur.

Other sciences such as geology, mathematics, and astrodynamics also are related to astronautics. The techniques of geology are used to study the nature and possible origins of the earth. Now these techniques are also being applied to planetary explorations. Mathematics is the language of the other sciences. In astronautics there is a constant demand for mathematicians, particularly those specializing in computer application. **Astrodynamics** deals with the motion of bodies outside the earth's atmosphere. It is related to

other scientific disciplines such as aerodynamics, geophysics, and electromagnetics and is chiefly concerned with the trajectories of space ships. The astrodynamicist must have a good background in mathematics, astronomy and celestial mechanics.

AEROSPACE JOBS IN GOVERNMENT AGENCIES

The US Government offers career opportunities both in space and in aviation.

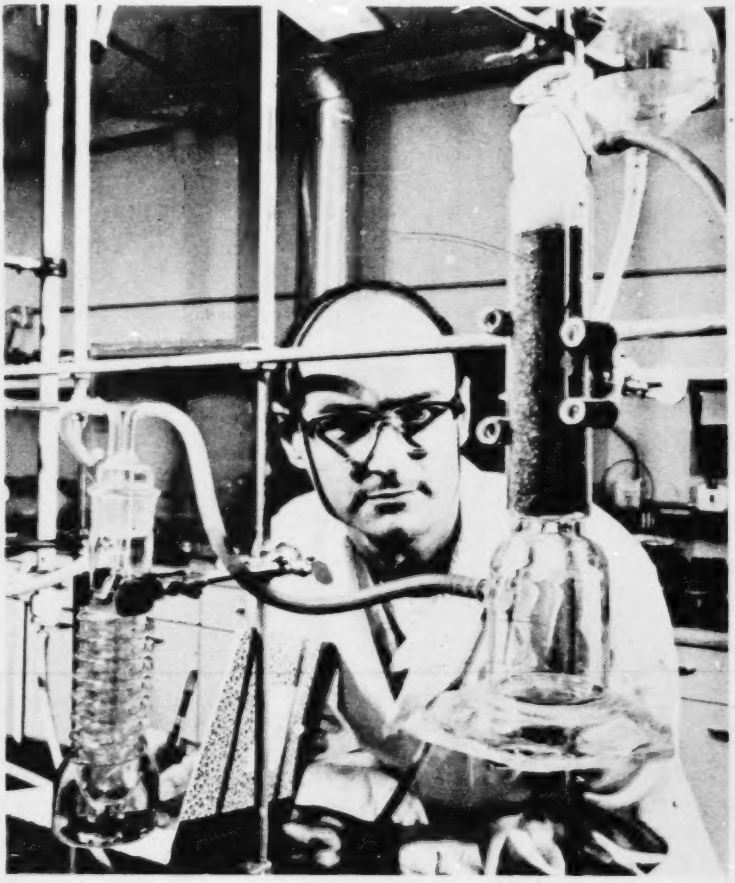

Figure 46. A space chemist preparing to perform a gas purification experiment that will assist him in the research of a new rocket motor solid propellant.

Figure 47. Biologist pours a growth medium into a seed-carrying glass fixture for spaceborne study.

Careers in NASA

The chief Government agency concerning itself with space research and space flight is the National Aeronautics and Space Administration (NASA). Only NASA and the Department of Defense have available to them the manpower, the network of bases, the launch facilities, monetary resources, and support teams necessary to carry out successful space programs

The Government established NASA to monitor those space programs that were not specifically military in nature. In fact, the US program has consistently emphasized the peaceful uses of space. NASA's accomplishments in space have enhanced US prestige worldwide. NASA draws upon the military and upon private contractors for most of its equipment, but it represents the Government in international space endeavors.

In addition to personnel who are ordinarily associated with Government agencies, NASA also hires scientists, engineers, technicians, and other professional personnel not ordinarily found in Government agencies. Most NASA personnel are "white collar" employees, but the agency does hire some skilled craftsmen. The breadth of NASA's space flight program dictates a need for specialists in many fields of knowledge, from human factors to theoretical astrophysics.

EDUCATION AT NASA.—A variety of educational programs are available through NASA to support personnel (technicians, other skilled craftsmen) as well as engineers and scientists. These programs include apprenticeships, specialized training, undergraduate instruction, and graduate education.

The apprenticeship program was initiated at Langley Research Center in 1941, 17 years before NASA's birth, to develop the specialized skills and knowledge required to keep methods and techniques abreast of the demands of advanced research. Changes have been made in the apprenticeship program as the demands for skilled craftsmen have changed. Today, the program is developing craftsmen in such fields as electronics, computer systems, model development for wind-tunnel testing, and machine shop work (Fig. 48). There is also a preapprentice program for high school students who have had no previous apprenticeship experience.

The Langley Center trains skilled mechanics, choosing its apprentices from the top of the list of applicants. On-the-job training and related study make up the course of instruction, and the instructors are taken from the Center's engineering and mechanical staffs. Basic physics and engineering drawing are required, and mathematics through calculus is taught.

The Center's cooperative program involves undergraduate college students in the field of engineering, physics, and chemistry. A number of Langley employees take credit or noncredit courses

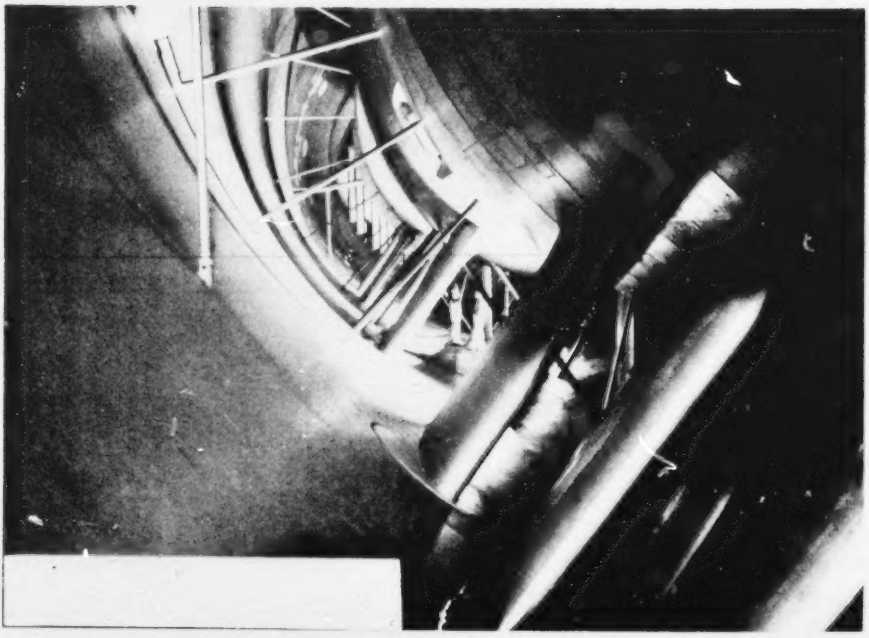

Figure 48. Interior view of the supersonic circuit of a 16-foot propulsion wind tunnel.

from nearby colleges and universities on a part-time or night school basis.

The opportunity for graduate study is available to the Center's employees during duty hours. The only courses approved for these employees are those which will help them in their work at the Center.

Government Aviation Careers

Federal, State, and local government agencies are a major source of aviation career opportunities. Most of the local and State aviation jobs are related to airport operations or directly involve piloting and maintenance of aircraft. Information on these jobs may be obtained from state employment service offices.

The FAA.—The largest number of aviation jobs in the Federal Government outside the military is found in the Federal Aviation Administration (FAA), which is a branch of the Department of Transportation. The agency is responsible for the administration and enforcement of all Federal air regulations to assure the safety of air transportation. The FAA also promotes, guides, and assists

in the development of a national system of civil airports and furnishes pilots with flight information.

Two major career opportunities in the FAA are air traffic control specialist and aviation safety officer.

There are two classifications of air **traffic control specialist** (Fig. 49), those working at airport traffic towers and those working at FAA air route traffic control centers. The **airport tower controllers** are responsible for controlling the flow of air traffic at and near air terminals. Among their many duties, they give pilots taxiing and takeoff instructions, air traffic clearances, and weather information. They also transfer and receive control of aircraft on instrument flights, operate the runway lighting systems, and operate airport traffic direction systems.

The control specialists at the FAA air route traffic control centers instruct and advise pilots along their flight paths as they fly Federal airways. These controllers keep track of all instrument flights within their control areas through the use of radar. They transfer control to the next control center whenever an instrument

Figure 49. Air traffic controllers directing aircraft traffic while students observe.

flight leaves their control area, and they receive control of flights entering their areas.

There are four classifications of FAA aviation safety officers: manufacturing inspector, aviation electronics inspector, maintenance inspector, and operations inspector. The **manufacturing inspector** checks the design materials and production methods used for producing civilian aircraft engines, systems, and equipment to insure that Federal Aviation Regulations safety standards are met and that the finished aircraft are airworthy. The **aviation electronics inspector** checks the communications and electronic navigation equipment on civilian aircraft to insure compliance with air safety rules relating to airworthiness and proper operation. He also checks the efficiency of the repairmen who work on electronic equipment and helps investigate accidents and violations of the safety rules. The **maintenance inspector** checks to see that air safety maintenance rules are complied with in aircraft maintenance, maintenance inspection procedures, spare parts stock, employee training programs, and all manuals dealing with aircraft maintenance. The **operations inspector** checks pilot competence and training for compliance to FAA safety rules and investigates accidents and violations of the rules.

THE CAB.—The Civil Aeronautics Board (CAB) is an independent agency of the Government that is concerned with aviation. The board regulates the economic aspects of aviation. This includes the issuing of certificates to American-owned airlines for both domestic and international service; the establishment of passenger fares and air routes; and rulings on any proposed merger, sale, or consolidation of air carriers.

The CAB represents the United States in certain kinds of international airline legal discussions. For these purposes, the CAB hires a number of lawyers who specialize in aviation law. Economists and statisticians are also numbered in the ranks of the CAB to help in the formulation of decisions on changes in airline rates, routes, and services.

THE NTSB.—The function of the National Transportation Safety Board (NTSB), an arm of the Department of Transportation, is to promote safety in all forms of transportation, including aviation. The Board investigates civil aircraft accidents occurring in the United States and its territories; determines the cause of the accidents; makes public reports on the accidents and their causes; makes safety recommendations intended to prevent similar occurrences; and ascertains what will best tend to reduce or eliminate the possibility of aircraft accidents. The board's investigators interview victims and witnesses of accidents, examine aircraft parts, instruments, engines, and maintenance and flight records to find the probable cause of airplane accidents.

OTHER GOVERNMENT AGENCIES.—These and other Federal agencies employ pilots, mechanics, and other aviation workers throughout the country. Pilots working for other Government agencies—such as the Department of Agriculture, the Department of the Interior, and the Department of Justice—fly their aircraft in the performance of numerous and varied duties. These functions include the transportation of office members and supplies, the performance of aerial surveys, wildlife censuses, checks on forest spraying, overseeing of forest fire-fighting procedures, tracking down people who enter the country illegally, and other functions as required by the particular Government office involved. They may fly in helicopters and fixed-wing aircraft during day or night, over all kinds of terrain, in all kinds of flyable weather.

CAREER OPPORTUNITIES IN THE AIR FORCE

The Air Force is one of the major sources of aerospace career opportunities. Both officers and enlisted personnel have a wide range of specialties from which to choose. The training and education available in most of these specialties qualify individuals for a similar career in civilian life. For example, a large number of civilian airline pilots, flight engineers, and mechanics received their training in the Air Force. This is also true of many other civilian jobs such as plumbing and electrical work.

Commissioned Opportunities

Not all Air Force officers are on flying status; but the Air Force requires all officers to have a college degree. The one exception to this policy is nursing; a nurse must be a currently **registered nurse** (RN) with a degree from an accredited school of nursing. Only a few of the many fields available to commissioned officers are discussed here.

RATED OFFICERS.—Officers qualified as pilots or navigators are rated officers.

Pilots may be trained to fly one or more types of aircraft such as fighters, bombers, or transports. The pilot's responsibilities go far beyond flying the plane. Pilots manage, direct, and command flying organizations at every level of command, and they are often involved in aircrew training (Fig. 50) and operations activities.

Navigators are needed for many kinds of flying activities, including transport, reconnaissance, troop carrier, and others (Fig. 51). The officer in this specialty must have a knowledge of air navigation and the fundamentals of meteorology, electronics, and electricity, and must be proficient in operating advanced navigation and radar equipment.

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NONRATED OFFICERS.—There are many jobs for nonrated officers in the Air Force. Some of these are directly related to flying, while others are not. However, all of these jobs support the primary flying mission of the Air Force.

Jobs directly related to aerospace include such specialties as aircraft maintenance, missile operations, science, and weather.

Aircraft maintenance officers are responsible for the management of personnel, resources, and activities which keep the planes

Figure 50. Student pilot and instructor.

Figure 51. Navigator plotting aircraft position, using data obtained from airborne radar equipment.

airworthy (Fig. 52). Individual officer responsibilities include supervising, organizing, scheduling, controlling personnel and material resources to meet operational flying requirements, and identifying mechanical or design deficiencies in aircraft and ground support equipment.

Officers working in **missile operations** have many responsibilities. Their duties include program formulation, inspection, training, and direction of ground-launched missile operations activities. Their responsibilities include supervision of launch sites, squadrons, groups, and wings which involve tactical missile employment and missile training. A missile operations assignment offers an unusual educational opportunity. Qualified officers in this job can obtain a master's degree in such fields as management, business administration, or economics through the **Minuteman Education Program (MMEP)** while performing their regular duties.

The scientific career field offers job opportunities to officers in such areas as chemistry, physics, metallurgy, biology, or nuclear research. These officers are generally assigned to one of the laboratories or test centers of the Air Force Systems Command (Fig. 53). Their work is primarily in basic research or exploratory de-

velopment (applied research). Some are assigned as instructors at the Air Force Academy or the Air University.

Weather officers are professional **meteorologists** who perform support services for the aviation and space operations of the Air Force. Unless they already have a Bachelor of Science degree in meteorology, weather officers spend their first year in the Air Force at a civilian college or university completing appropriate meteorology courses.

Commissioned jobs not directly related to flying include such jobs as administration, education and training, personnel, finance, and civil engineering.

Administration is divided into two distinct specialties, administration management and executive support.

Figure 52. Maintenance officer checking equipment.

Figure 53. Officer in scientific research inspecting a laser vibrometer in a laser instrumentation laboratory at Arnold Engineering Development Center.

Administration management officers hold positions at every level of command and work directly with the commander. All communications to or from the command section or staff agencies are processed through the administration management officer (usually called Chief or Director of Administration).

Executive support officers are assigned to such varied duties as commanding a squadron section or serving as protocol officer or general's aide.

Officers in the education and training field are responsible for managing education and training programs involving Air Force personnel. Their duties include evaluating curriculum materials, training devices, and measurement systems. A bachelor's degree in education or psychology is desirable for entering this field. Officers who have completed an instructor training course or who have had teaching experience have a definite advantage in the education and training field.

Officers in personnel work are responsible for the management of Air Force personnel resources. This involves handling such personnel problems as career information and guidance, testing for promotions, on the job training, and assignment to formal school training. New **personnel officers** are first assigned at base level to

a Consolidated Base Personnel Office (CBPO). Usually, the assignment will be as officer in charge (OIC) of one of the CBPO sections such as Processing or Personal Affairs.

The duties of **accounting and finance officers** involve paying the troops, as well as providing records of all of the financial transactions which take place on the base. Budget officers help commanders at every level plan budgets. Auditors review accounting and finance activities to evaluate the efficiency of Air Force financial operations.

Civil engineering officers are responsible for the construction, maintenance, and repair of Air Force property and installed equipment, the operation of utility systems, and for fire prevention and aircraft crash rescue operations. Their duties include preparing contracts, plans, and specifications; planning construction and maintenance programs; acquiring, using, and disposing of real estate; and administering family housing. Completion of the five-week Base Civil Engineering Course at the Air Force Institute of Technology, Wright-Patterson AFB, Ohio is required for all officers newly assigned to civil engineering.

Air Force officers also serve in many of the professional fields such as medicine and law. Doctors, nurses, and lawyers in the Air Force have jobs similar to their civilian counterparts. Doctors may, however, specialize in aerospace medicine; and nurses may specialize in flight nursing, which involves providing nursing care while actually in flight. Lawyers in the Air Force must learn a new set of laws—the **Uniform Code of Military Justice (UCMJ)**—which has jurisdiction over all military personnel. The UCMJ, similar in many aspects to civilian law, guarantees the rights of military personnel to fair and equal treatment and sets up procedures for dealing with military crimes.

Military personnel actually come under both **civil law** and **military law.** Crimes such as murder and theft are offenses under both civil and military law, but some military crimes such as absence without leave (AWOL) or desertion have no civilian counterparts.

Military members' rights however are protected as much as the rights of civilians. All convictions are automatically reviewed, even without an appeal, and the UCMJ provides safeguards for protecting the rights of the accused. These rights are similar to the safeguards of the Bill of Rights of the Constitution. For example, Article 31 of the UCMJ is similar to the 5th Amendment and protects against self-incrimination. Article 31 also guarantees accused persons the right to legal counsel. Thus, lawyers in the Air Force may, as in civilian life, be called upon to defend the accused as well as to prosecute the Government's case.

One aspect of the Air Force officer's corps which has not been mentioned is the fact that female officers are increasing in number and entering formerly all-male fields. Women in the Air Force (WAF) are not a separate corps but are an integral part of the Air Force. Almost all career fields are open to women —the only exceptions are those which are directly related to combat. By law, all women, except flight nurses, are excluded from flying in combat situations. The practical effect of this law is to exclude women from being pilots, navigators, or missile launch officers.

The Air Force policy is that a pilot must be able to accept an assignment in any type of aircraft including fighters and bombers, and this precludes women from becoming Air Force pilots. At present women make up about 3 percent of the officer corps, with about 1,200 female officers on active duty. This does not include the several thousand AF nurses because they are in the medical corps, which is administered separately. At present, the highest ranking female officer is Maj Gen Jeanne Holm, who was formerly the Director of Personnel, WAF. She has announced that the Air Force plans to triple the number of women in the Air Force. This goal is expected to be reached by 1978.

Officer Promotions

The primary purpose of the promotion system is to select the best qualified officers available to fill Air Force positions. Promotion is not a reward for past services; it is an advancement based on each officer's demonstrated potential for filling a position of greater responsibility.

A fundamental principle of the Air Force promotion system is that an officer must remain at a given level long enough to profit by his experience but not long enough to lose interest and initiative. He must remain in grade long enough to accumulate a performance record that can be reviewed by a selection board in considering his promotion to the next grade.

Three other principles are also basic to the promotion system: career motivation, selectivity, and force vitality. To provide **career motivation,** the system offers incentive to the officers that is, a reasonable opportunity for promotion at reasonably spaced intervals. It offers promotion opportunities for each year group which are comparable to those of other year groups. **Selectivity** is necessary if the system is to meet the Air Force need—the best qualified officers for the positions available. Therefore, the system provides for elimination of those who cannot successfully compete. Also, the system maintains **force vitality** by producing an officer force sufficient in quantity and quality to support national objectives.

Air Force promotion management can be pictured as a pyramid (Fig. 54) which rises from a broad base of junior officers to a relatively small number of general officers at the top. In the company grades (second lieutenant through captain), up to 100 percent of the officers may be promoted. The percentage decreases for higher grades. Theoretically, every officer has the same opportunity as his contemporaries to reach the top.

The promotion plan allows qualified officers to advance while they are still physically and mentally young enough to meet the demands of higher positions. It also recognizes outstanding officers and advances them more rapidly than at the normal rate. Thus the plan provides promotion opportunity for both dependable performers and outstanding performers.

The number of selections for promotion cannot exceed a legally established limit. The dependable officer can expect to be promoted at specific time intervals in his career. Such promotions are said to be made in the "primary zone." If an officer is outstanding, he may be promoted ahead of his contemporaries. Such promotions are said to be made in the "secondary zone" or "below the zone" (Fig. 55). Those officers who are not dependable performers will not be promoted and may be released from the Air Force.

Enlisted Opportunities

Not too long ago certain ideas about careers began to gain wide acceptance among young people and their parents: (1) a college degree is a "must" if you are to have a worthwhile career; (2) all the high-paying jobs require a college degree; (3) vocational training is a last resort for those who, for financial

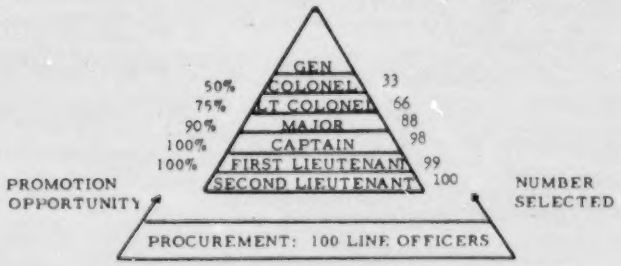

Figure 54. Promotion management pyramid. Selection pattern for 100 line officers advancing through the promotion system, exclusive of retirements, releases, and resignations.

Dependable Performer	--Primary Zone	Oportunity
1st Lt	1½ Years	
Captain	3 Years	Fully Qu[illegible]ied (100%)
Major	11 Years	[illegible]%
Lt Colonel	17 Years	7[illegible]%
Colonel	21 Years	50%

Outstanding Officer	--Secondary Zone (1)	Opportunity
Major	8 to 10 Years	5%
Lt Colonel	11 to 16 Years	7½%
Colonel	13 to 20 Years	15%

Figure 55. Promotion phase points.

or other reasons, cannot go to college; and (4) there is something inferior about earning a living with your hands.

None of these ideas has any foundation. In fact, skilled technicians—mechanics, electricians, plumbers, electronics specialists, to name a few—are much in demand and earn excellent pay, often higher than many white-collar workers. Furthermore, they find these careers to be interesting and satisfying.

Job opportunities for vocationally and technically trained specialists are increasing rapidly in almost every field. The problem has been for vocational/technical schools to keep up with the rapid advances in technology.

The Air Force has done this. The Air Force vocational training program not only provides up-to-date training with up-to-date equipment, but it has developed a special transcript to record the airman's education and work experience in a way that will be meaningful to labor unions, employers, and colleges when he returns to civilian life.

For those who want to enter the Air Force, the first step is to take the **Airman Qualifying Examination (AQE).** This test can be taken before enlistment by applying at the nearest Air Force recruiting office. It involves no cost or obligation. The examination covers four career fields: mechanical, electronic, administrative, and general occupational. Whether a person joins the Air Force or not, the results of the examination are helpful in determining which fields are best suited to the individual's aptitudes.

The Air Force guarantees the prospective airman his choice of jobs provided there is an opening. A list of guaranteed jobs is shown in Figure 56. If there is no opening immediately available,

LIST OF AFSCs IN GUARANTEED ENLISTMENT PROGRAM

(as of 1 June 1972)

AFSC	TITLE
23334	Still Photographic Laboratory Specialist
25231	Weather Observer
27130	Air Operations Specialist
29333	Radio Operator
30331	Air Traffic Control Radar Repairman
30332	Aircraft Control and Warning Radar Repairman
30333	Automatic Tracking Radar Repairman
30430	Radio Relay Equipment Repairman
30431	Flight Facilities Equipment Repairman
30434	Ground Radio Communications Equipment Repairman
30534	Electronic Computer Systems Repairman
30730	Telecommunications Systems Control Attendant
32130	Bomb-Navigation Systems Mechanic
32231	Weapon Control Systems Mechanic
32330	Defensive FCS Mechanic
32430	Precision Measuring Equipment Specialist
32530	Automatic Flight Control Systems Specialist
32531	Avionics Instrument Systems Specialist
32630	Avionics Aerospace Ground Equipment Specialist
32631	Integrated Avionics Components Specialist
32830	Avionic Communications Specialist
32831	Avionic Navigation Systems Specialist
32833	Electronic Warfare Systems Specialist
32834	Avionic Inertial and Radar Navigation Systems Specialist
32930	Avionic Sensor Systems Specialist
34131	Instrument Trainer Specialist
34230	Flight Simulator Specialist
36130	Outside Wire and Antenna Maintenance Repairman
36231	Telephone Switching Equipment Repairman, Electro/Mechanical
39130	Maintenance Analysis Specialist
42131	Aircraft Propeller Repairman
42132	Aircraft Pneudraulic Repairman
42133	Aerospace Ground Equipment Repairman
42230	Instrument Repairman
42231	Aircraft Environmental Systems Repairman
42232	Aircraft Egress Systems Repairman
42330	Aircraft Electrical Repairman
42430	Aircraft Fuel Systems Mechanic
43130	Helicopter Mechanic
43131	Aircraft Maintenance Specialist
43230	Jet Engine Mechanic
43231	Reciprocating Engine Mechanic
47231	Special Vehicle Repairman
47330	General Purpose Vehicle Repairman
53230	Metals Processing Specialist
53430	Airframe Repair Specialist
53530	Corrosion Control Specialist
53630	Nondestructive Inspection Specialist
54230	Electrician
54330	Electrical Power Production Specialist
54430	Cryogenic Fluids Production Specialist
54530	Refrigeration and Air Conditioning Specialist
54730	Heating Systems Specialist
91530	Medical Material Specialist
55130	Pavements Maintenance Specialist
55131	Construction Equipment Operator
55230	Carpentry Specialist
55234	Protective Coating Specialist
55235	Plumbing Specialist
56330	Engineer Environmental Suport Specialist
57130	Fire Protection Speciadist
58130	Parachute Rigger
58230	Fabric and Rubber Products Specialist
60134	Packaging Specialist
60230	Passenger and Household Goods Specialist
60231	Freight Traffic Specialist
60330	Vehicle Operator/Dispatcher
60530	Air Passenger Specialist
60531	Air Cargo Specialist
62130	Baker
62230	Cook
62231	Diet Therapy Specialist
63130	Fuel Specialist
64530	Inventory Management Specialist
64730	Materiel Facilities Specialist
67131	General Accounting Specialist
67133	Disbursement Accounting Specialist
10230	Administration Specialist
73230	Personnel Specialist
74130	Athletic Specialist
74131	Recreation Specialist
75130	Education Specialist
79130	Information Specialist
81130	Security Specialist
81230	Law Enforcement Specialist
90230	Medical Service Specialist
90232	Operating Room Specialist
90330	Radiology Specialist
90430	Medical Laboratory Specialist
90530	Pharmacy Specialist
90630	Medical Administrative Specialist
92230	Protective Equipment Specialist
98130	Dental Specialist

Figure 56. Jobs in the Guaranteed Enlistment Program.

the recruiting office can arrange for him to enlist within his chosen field (mechanical, administrative, general, or electronic). Under this option the airman will be assigned to one of the jobs in that field upon completion of basic training. The job he receives is determined during basic training, at which time he is permitted to select his job preference from a list of existing vacancies.

As with commissioned jobs, some enlisted jobs directly involve flying; some are related to aerospace.

FLYING JOBS.—Several enlisted jobs involve actual flying, but only two will be discussed here—flight engineer specialist and loadmaster technician.

Some of the duties of **Air Force flight engineers** are to perform aircraft inspections and nonscheduled maintenance when the plane is away from the home base. The flight engineer must also compute aircraft performance data such as takeoff, climb, cruise, and landing speed; and he must determine fuel consumption requirements. Additionally, he assists the pilot in engine starting and shutdown and monitors engine instruments throughout the flight.

Two nine-week advanced flight engineer courses are conducted at Altus AFB for training in the C-5 and the C-141 transport aircraft.

An aircraft **loadmaster technician** is responsible for loading and offloading aircraft. When cargo or personnel must be airdropped, the loadmaster supervises the airdrop and is responsible for insuring that the airdrop equipment is always in working order (Fig. 57). While on board the aircraft, the loadmaster demonstrates

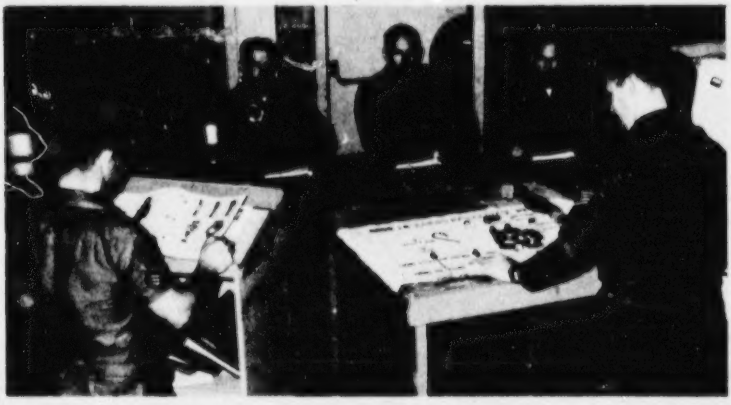

Figure 57. Personnel in the Military Airlift Command, McChord AFB, instructing a class in the rigging of airdrop loads.

Figure 58. Jet engine mechanics working on an F-4 Phantom.

the use of emergency equipment such as oxygen masks and parachutes, and he conducts the emergency evacuation procedures of the passengers if required.

Advanced loadmaster training is given in an eight-week course at Hill AFB, Utah.

JOBS DIRECTLY RELATED TO AEROSPACE.—Jobs, such as jet engine mechanic, avionics navigation systems specialist, avionics communications specialist, and air traffic controller, are representative of this category.

The **jet engine mechanic** installs, removes, disassembles, assembles, inspects, repairs, services, tests, and modifies all types of jet engines and their components (Fig. 58). He also analyzes operating engines and makes necessary adjustments. To qualify as a jet engine mechanic an 11-week course at the Jet Engine Mechanic Course, Chanute AFB, Rantoul, Illinois, must be completed.

The specialist who keeps the navigation electronic equipment in operating condition is the **avionics navigation systems specialist.** His duties are to install, maintain, repair, and test airborne electronic navigation equipment. The technical training requirement for this job is attendance at the Avionics Navigation Systems Specialist Course (33 weeks) at Keesler AFB, Biloxi, Mississippi.

The **avionics communications specialist** conducts preventive maintenance on Air Force radio equipment by inspecting and testing to locate defects. He makes necessary adjustments and replaces or repairs defective parts when necessary. He also evaluates equipment performance while it is in operation and checks and installs new equipment. The training for this job is given in a 29-week Avionics Communications Specialist Course at Keesler AFB, Biloxi, Mississippi.

The air traffic control operator directs or assists in directing the flow of air traffice arriving at or departing from his base, using visual radar, and conventional means (Fig. 59). His duties are much the same as those of FAA air traffic controllers described earlier in this chapter. The Air Force air traffic controller issues clearances, instructions, and advisories to the pilots. He also issues weather advisories, provides flight assistance and emergency service to aircraft, and performs many other duties. The training

Figure 59. Air traffic control operator directing aircraft landing and takeoff.

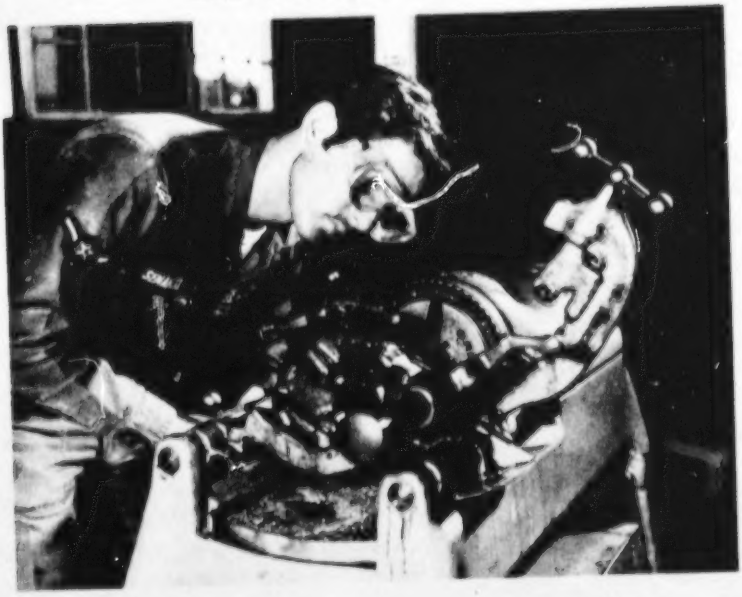

Figure 60. Two-inch pipe being threaded by plumbing specialist.

requirement for air traffic control operator is the 24-week Air Traffic Controller Course at Keesler AFB, Biloxi, Mississippi.

JOBS NOT DIRECTLY RELATED TO AEROSPACE.—All Air Force jobs are not directly related to flying. The jobs described below are among the many in this category.

Trained and experienced **plumbing specialists** gain a skill with a future. Plumbing specialists must be able to install, repair, or replace pipe systems and plumbing fixtures (Fig. 60). This involves reading and interpreting blueprints or other specifications, determining dimensions and the kind and quality of materials needed for a project, determining the method of installation, and selecting entry and exit points for pipe connections. Installations may be in many different locations, even at mobile or stationary missile facilities. A basic knowledge of plumbing qualifies a person as an Air Force plumbing specialist. The advanced knowledge and skills needed are acquired by on-the-job training. Additionally, there is a 9-week Plumbing Specialist Course at Sheppard AFB, Wichita Falls, Texas, which teaches the various skills required in this specialty.

Electricians are in continuous demand in the Air Force and in civilian life. Air Force electricians install, maintain, and repair electrical and electronic equipment. The basic requirements for

this job are aptitude and prior knowledge. Advanced skill is acquired by on-the-job training. Many Air Force electricians attend the nine-week Electricians Course at Sheppard AFB which covers the fundamentals of electricity and the theory of operation, maintenance, and repair.

Communication is a necessary Air Force activity. Large numbers of letters, messages, and records must be prepared and transmitted to operate the Air Force. This work is done by **administration specialists.** These specialists draft, type and control correspondence, messages, forms, orders, reports, schedules, and inventories. They also operate the postal system within the Air Force, conduct records management training courses, receive and control security documents, and operate the various equipment connected with administrative work. Previous experience and on-the-job training qualify airmen for this specialty. An Administrative Specialist Course at Keesler AFB is available to teach typing and the other skills necessary for the specialty.

The job of **medical service specialist** is one that has value for the future (Fig. 61). Qualified airmen work side by side with doctors and nurses in Air Force medical facilities. They assist with planning and giving nursing care to all types of patients. They measure and record temperature, pulse rates, respiration, and

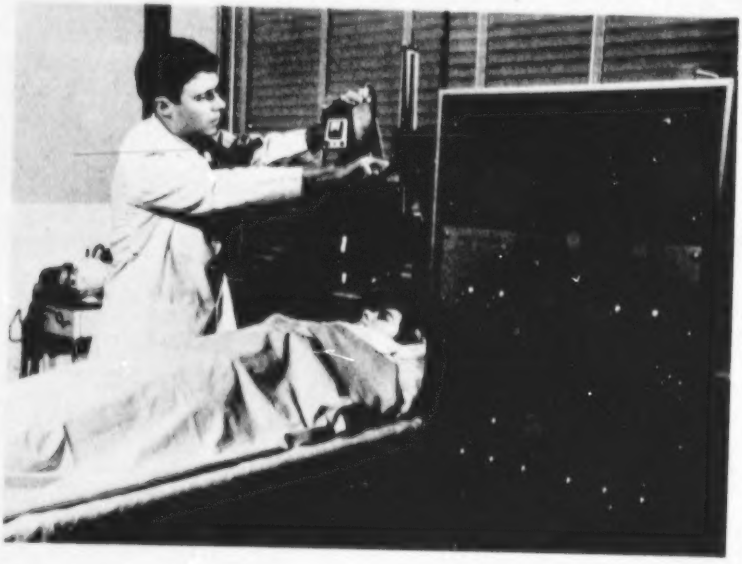

Figure 61. Medical services specialist performing radioactive technetium brain scan on a patient.

blood pressure. They help prepare patients for surgery, observe and report on patients in serious condition or recovering from anesthesia, and give medication under supervision of a nurse or a doctor. Completion of the Medical Service Specialist Course (12 weeks) at Sheppard AFB is required to qualify for this specialty. The course trains airmen to assist professional personnel in providing care and treatment in nursing units, dispensaries, and clinics.

As with officers, the number of enlisted women should triple over the next four years. At present there are about 13,000 enlisted women on active duty.

Enlisted Promotions

During basic training at Lackland AFB, an enlisted man is an airman basic or an E-1. He remains in this status for a specified time period and then becomes an airman or E-2. The rest of his promotions are related to his time in grade and his advancement within his chosen Air Force Specialty Code (AFSC). To advance to airman 1st class, or E-3, he must have a given amount of time in grade and have demonstrated his ability to advance within his AFSC to the "three" level. There are five different levels within each AFSC (the 1, 3, 5, 7 and 9 levels), each representing a greater degree of proficiency (Fig. 62). Promotion to sergeant, or E-4, depends on time-in-grade and the concurrence of his supervisor and squadron commander.

The promotion selection system for airmen in grades E-5 through E-7 (staff, technical, and master sergeants) is called the **Weighted Airman Promotion System (WAPS).** Under WAPS airmen are selected for promotion based on the total score of

For Promotion TO	Time in Service[1]	Grade	Skill Level
CMSgt (E–9)	14 Years	24 months	9
SMSgt (E–8)	11 Years	24 months 3	7 or 9
MSgt (E–7)	8 Years	24 months	7
TSgt (E–6)	5 Years	18 months	
SSgt (E–5)	3 Years	12 months	3 or 5 (depending on career field
Sgt (E–4)	1 Year	8 months	3 (On promotion effective date)
AIC (E–3)		8 months 1&2	
Amm (E–2)	4 Months	4 months 1&2	

Figure 62. Promotion eligibility requirements.

weighted factors: specialty knowledge test (SKT), promotion fitness examination (PFE), time in service, time in grade, decorations, and performance reports (Fig. 63).

Eligible airmen compete worldwide with all other airmen in the same grade and specialty. The number of vacancies determines how many airmen who qualify under WAPS will be selected each promotion cycle, but every eligible airman gets a chance to compete for the jobs available. In the case of tie scores, all the airman with qualifying tie scores will be promoted.

During each promotion cycle, every eligible airman is scheduled for a review of his Promotion Eligibility Verification Record. This record contains all the information, with the exception of the test scores, which will be used by the Military Personnel Center in considering the airman for promotion. The review is important in that it gives the airman the opportunity to correct errors that might otherwise go unnoticed.

Promotion to grades E-8 and E-9, senior master sergeant and chief master sergeant, are made by recommendations of promotion boards.

CONCLUSION

No matter what career you select, your life will be influenced by the aerospace community.

In this text we have presented various aspects of the aerospace community and the opportunities for a career in aerospace, both civilian and military.

With few exceptions, the job opportunities in the Air Force for officer and enlisted personnel have their civilian counterparts. The training and experience you will receive in the Air Force in your chosen field will put you well ahead in the competition for jobs if you return to civilian life.

Factor	Maximum Points
Specialty Knowledge Test(SKT) Score	100
Promotion Fitness Examination(PFE) Score	100
Time-in-service	40
Time-in-grade	60
Decorations	25
Performance Reports	135
Total	460

Figure 63. Weighted factors and maximum scores used in WAPS.

The Air Force does not claim to be a shortcut to success, but it offers many advantages in day-to-day living, education, income, and promotion. If you make the Air Force a career, there are also the later advantages of good retirement income and the continued use of military facilities (commisary, BX, medical attention, and clubs) for yourself and your dependents.

One fact is clear. The aerospace community is a major factor in the economy and everyday living of the United States. It includes more different products and types of occupation than any other field today, and it will continue to change and expand in the years to come.

WORDS AND TERMS TO REMEMBER

astronautics
Minuteman Education Program (MEP)
Uniform Code of Military Justice (UCMJ)
civil law
military law
career motivation
selectivity
force vitality
Airman Qualifying Examination (AQE)
Weighted Airman Promotion System (WAPS)

CAREERS DISCUSSED IN THIS CHAPTER

A and P mechanic
accounting and finance officer
administration management officer
administration specialist
aerospace engineer
Air Force flight engineer
aircraft maintenance officer
airline dispatcher
airport tower controller
astrobiology
astrochemistry
astrodynamics
astronomer
aviation electronics inspector
aviation mechanic
avionics communications specialist
avionics navigation systems specialist
captain
civil engineering officer
communication and tracking engineer
construction engineer
copilot
electricians
engineering technician
executive support officer
flight engineer
guidance and control engineer

instrumentation engineer
jet engine mechanic
loadmaster technician
maintenance inspector
manufacturing inspector
materials engineer
medical service specialist
meteorologist
missile operations
navigator
operations inspector
personnel officer
pilot
plumbing specialist
power supply engineer
propulsion engineer
Registered Nurse
space chemist
space medicine
steward
stewardess
systems engineer
traffic control specialist
traffic representative

REVIEW QUESTIONS

1. **What are the three steps in the progression of an airline pilot's career?**
2. **What are some of the duties of an airline dispatcher?**
3. **What is the difference between an engineer and a technician? Name some different kinds of aerospace engineers.**
4. **Name several ways scientists are involved in the aerospace industry.**
5. **Describe the job of an air traffic controller. What is the difference between an airport tower controller and an air route traffic controller?**
6. **Distinguish between rated and nonrated AF officers. Why are women prevented from becoming rated AF officers?**
7. **What is the UCMJ?**
8. **What are some enlisted jobs which involve flying or are otherwise related to aerospace?**
9. **Name three enlisted jobs which are not related to aerospace.**
10. **State your evaluation of the Air Force promotion system.**

THINGS TO DO

1. Research a career in which you are interested. Find out the necessary qualifications for the job and the education you must have. Report to the class.
2. Choose an Air Force occupation and find out if it does (or does not) have a civilian counterpart. Report to the class on the similarities and differences.
3. Visit an airport or an aerospace company and talk to the people about their work in aerospace, or invite someone involved in the aerospace industry—pilot, stewardess, engineer—to talk to the class.

4. Talk to someone working in civilian industry. Explain the Air Force promotion system to him and compare it with his or her promotion opportunities.

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Suggested Air Force Manuals and Pamphlets

AFM 36–1, *Officer Classification Manual.*

AFM 39–1, *Airman Classification Manual.*

AFP 36–18, *Officer Career Information.*

AFM 39–7, *Airman Career Information.*

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The following is a list of subjects of interest to the study of the aerospace community, including many of the items listed in the "Words, Phrases, and Names To Remember" sections at the end of each chapter, plus other entries. Terms in this list are adequately explained in the text, usually where first mentioned. Page references locate passages where the items are defined, discussed, or explained.

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